भारतीय प्रबंध संस्थान बेंगलूर
INDIAN INSTITUTE OF MANAGEMENT
BANGALORE

NOTICE INVITING TENDER

(NIT No.PM/NIIMB/MDC/2024-25/01)

Work: Proposed Additional & Modifications Works to Existing MDC Block @ Survey No 47, Mahanthalingapura Village, Jigani Hobli Anekal Taluk, Bengaluru urban district.

ISSUED TO:

Project Manager

Signature of the contractor with seal

Work: **Proposed Additional & Modifications Works to Existing MDC Block @ Survey No 47, Mahanthalingapura Village, Jigani Hobli Anekal Taluk, Bengaluru urban district.**

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Signature of the contractor with seal

1.NOTICE INVITING TENDER
NIT No.PM/NIIMB/MDC/2024-25/01

Sl.No	Particulars	Date
1	Release of Advertisement	30/05/2024
2	e-Tender website for participation of Technical and Financial Bid	CPP Portal http://eprocure.gov.in/eprocure/app.
3	Date & Time of Online Publication/Download of Tender	30/05/2024,17:00 hrs
4	The EMD amount must be paid online transfer to bank details are as below. Bank Name- HDFC Bank Ltd Bank Street Address:J.P.NAGAR BRANCH, BANGALORE Branch Code: 0133 IFSC CODE: HDFC 0000133 Customer HDFC Bank a/c name: Indian Institute of Management Customer HDFC Bank a/c number: 01331450000019 Amount Remitted, Date and Reference to be enclosed. BG can be furnished, such bank guarantee shall be valid for the period of 120 days from the date of opening of the Technical Bid. The scanned copy of the BG should be uploaded with the technical Bid. The original Bank Guarantee must be delivered to address mentioned below on or before bid submission date and time failing which the bid shall be rejected. (No EMD Exemption for MSME or MSE Vendors) Project Manager Indian Institute of Management Bannerghatta Road Bangalore-560076.	3,50,000/-
4	Pre bid meeting schedule. a) Date of pre bid meeting. b) Time of pre bid meeting. c) Place of pre bid meeting	 a)12/06/2024 b) 15.30 hours c) The pre bid meeting will be either online on Zoom platform or offline in IIMB Bannerghatta Campus. Information will be uploaded at http://eprocure.gov.in/eprocure/app portal and IIMB website.

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5	Technical & Financial e- bid Submission	Vendor Should submit the Technical & Financial e-bid through e- tender mode only. CPP Portal http://eprocure.gov.in/eprocure/app.
6	Last date and time of online Submission of Bids (Both Technical and Financial Bids)	26/06/2024, 15:00 hrs
7	Opening of Technical Bid	27/06/2024, 15:30 hrs
8	Date & Time of Opening of Financial bid	Will be intimated to the Technically Qualified bidders.

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2.LETTER OF SUBMISSION

From

To

The Director,
Indian Institute of Management Bangalore
Bannerghatta Road,
Bangalore-560 076.

Description of work: Proposed Additional & Modifications Works to Existing MDC Block @ Survey No 47, Mahanthalingapura Village, Jigani Hobli Anekal Taluk, Bengaluru urban district.

Ref: **NIT No.PM/NIIMB/MDC/2024-25/01**

Dear Sir,
Having examined the details given in tender document for the above work, I/We hereby submit the bid and other relevant information.

1) I/We hereby certify that all the statements made and information supplied in the enclosed forms and accompanying statement are true and correct.
2) I/We have furnished all information and details necessary for submission of bid and have no further pertinent information to supply.
3) I/We submit the requisite certified certificate from bank and authorize IIMB, to approach the Bank issuing the certificate to confirm the correctness thereof. I/we also authorize IIMB to approach individuals, employers, firms and corporation to verify our competence and general reputation.
4) My/Our Tender shall be valid for a period of 120 days from the date fixed for the tender submission deadline in accordance with the Tender Document, and it shall remain binding upon us and may be accepted at any time before the expiration of that period.
5) If my/our Tender is accepted, we commit to obtain a Performance Security in the amount as specified in the tender document for the due performance of the Contract and sign the agreement;
6) I/We understand that this Tender, together with your written acceptance thereof included in your letter of acceptance, shall constitute a binding contract between us, until a formal Contract is prepared and executed.
7) I/We understand that you are not bound to accept the lowest evaluated tender or any other tender that you may receive.
8) I/We hereby declare that, the entire work including Addendum/ Corrigendum, if any, shall be completed

Signature of the contractor with seal

in all respect within the time limit specified in the NIT.

9) I/We here by authorize the Employer to get all bank guarantee verified and got confirmed from concerned Bank.
10) I/we undertake and confirm that our firm/partnership firm has not been blacklisted by any state/Central departments /PSUs /Autonomous bodies during the last 7 years of its operations. Further that, if such information comes to the notice of the department then I/we shall be debarred for bidding in IIM Bengaluru in future forever. Also, if such information comes to the notice of department on any day before date of start of work, the Engineer-in-charge shall be free to cancel the agreement.(Scanned copy of this notarized affidavit to be uploaded at the time of submission of bid).
11) I/We undertake and confirm that eligible similar work(s) has/have not been got executed through another contractor on back to back basis. Further that, if such a violation comes to the notice of Department, then I/We shall be debarred for tendering in CPWD in future for ever. Also, if such a violation comes to the notice of Department before date of start of work, the Engineer-in-Charge shall be free to cancel the agreement.
12) I/We submit the certificates in support of our suitability, technical knowhow and capability for having successfully completed the works.
13) I have furnished all the contact information such as postal address, telephone and fax numbers, e mail etc.

Seal of contractor

Date of submission:--

Signature(s) of Contractor.

Signature of the contractor with seal

3 BRIEF PARTICULARS OF THE WORK

3.1 General.

Salient details of the work for which bids are invited are as under:

NAME OF THE WORK: Proposed Additional & Modifications Works to Existing MDC Block @ Survey No 47, Mahanthalingapura Village, Jigani Hobli Anekal Taluk, Bengaluru urban district.

- Time of Completion of work: 5 months

3.2 SCOPE OF WORK

The proposed scope of work shall include Civil, Electrical and HVAC works.

Signature of the contractor with seal

4.0 Information and instructions to contractor

4.1 DEFINITIONS:

In this document the following words and expressions have the meaning hereby assigned to them.

- Employer, Institute, Authority, and IIM. Bangalore: Mean Indian Institute of Management, Bangalore acting through its Director or nominated person.
- Contractor: Means the individual, proprietary concern, partnership firm, private or public limited company applying for the pre-qualification.
- "Year": means "Financial Year" unless stated otherwise.
- "PQ": means pre-qualification or Technical Bid & Financial e- bid as per e- bid conditions.

4.12 GENERAL INFORMATION:

I. Incomplete details are liable to be rejected and no correspondence will be entertained during the process.

II. Language of tender: The language for submission of application should be English.

III. **Period of validity of tender:** Tenders shall be valid for 120 days from the last date of submission of the tender. IIMB will not be responsible for any costs or expenses incurred by Tenderers in connection with the preparation or delivery of Tenders. If any tenderer withdraws his tender before the said period or issue of letter of acceptance/intent, whichever is earlier, or makes any modifications in the terms and conditions of the tender which are not acceptable to the IIMB, then the IIMB shall, without prejudice to any other right or remedy, debarred for bidding for IIMB tenders for a period of 3 years and also forfeiture of EMD.

IV. **Period for completion of work:** The duration for completion of project works is 5 months from date of Handing over of site upon issue of Letter of Award.

V. No cost of whatsoever will be paid towards site visits, etc, during **bid evaluation**/progress of the work.

VI. While submitting the schedule duly filled in, the Contractor shall enclose latest copies of brochures and technical documentation giving more information about the firm.

VII. The contractor should organize for inspection of their previous works done at their own cost if required by the technical evaluation committee of IIMB/ PMC/Architects

VIII. All information called for in the enclosed forms shall be furnished against the relevant columns in the forms. If for any reason, information is furnished on a separate sheet, this fact shall be mentioned against the relevant column. Even if no information is to be provided in a column, a "nil/not applicable/ no such case" entry shall be made in that column. If any particulars/ queries are not applicable in case of the contractor, it shall be stated as "not applicable". The contractors are cautioned that not giving complete information called for in the application forms or not giving it in clear terms or making any change in the

Signature of the contractor with seal

prescribed forms or deliberately suppressing the information may result in the contractor being automatically disqualified. Applications received late will not be entertained.

IX. The application shall be page numbered and each page shall be signed & stamped.

X. Overwriting shall be avoided. Correction, if any, shall be made by neatly crossing out, initialling, dating and rewriting.

XI. References, information and certificates from previous clients certifying suitability, technical knowhow or capability, quality of work of the contractor shall be signed by an officer not below the rank of Executive Engineer or equivalent.

XII. The contractor may furnish any additional information, which he thinks is necessary to establish his capabilities to successfully complete the envisaged work. He is, however, advised not to furnish superfluous information. No information shall be entertained after submission of pre-qualification document unless the specifically required by and asked for by IIMB.

XIII. Any information furnished by the contractor found to be incorrect either immediately or at a later date, would render him automatically disqualified.

XIV. Contractors are advised to keep visiting http://eprocure.gov.in/eprocure/app and IIM Bangalore's website (Tender Notices | IIM Bangalore) from time to time (till the deadline for bid submission) for any updates /amendments /modifications in respect of the tender notice, if any. Failure to do so shall not absolve the contractor of his liabilities to submit its bid application complete in all respect including updates thereof, if any. An incomplete bid application-will be \rejected.

XV. IIM Bangalore reserves the right to verify the particulars furnished by the contractor independently. If any information furnished by the contractor is found incorrect at a later stage, he shall be debarred from tendering and taking up of any work in IIM Bangalore.

XVI. Documents submitted in connection with bid submission will be treated confidential and will not be returned.

XVII. Arbitration: In case, any dispute or difference shall arise between the parties during the progress of work or after construction or abandonment of the work as to the meaning of construction of this contract or touching or relating either to the said buildings or works, or to any other matter of thing arising directly or indirectly under this contract, then and in such an event the same shall be referred to arbitration by the Director of the Institute of Management Bangalore as the Sole Arbitrator who shall alone consider and determine the same and whose award shall be binding and conclusive upon both the said parties and this clause shall be deemed a submission within the meaning of the Arbitration and Conciliation Act, 1996, or statutory modification or re-enactment thereof.

XVIII. The venue of arbitration proceedings shall be Bangalore as per CPWD Norms.

XIX. It is further agreed between the parties hereto that the Bangalore Courts alone shall have the exclusive jurisdiction.

XX. IIM Bangalore reserves the right to reject any or all prospective applications without assigning any reason and to restrict the list of pre-qualified contractors to any number deemed suitable.

Signature of the contractor with seal

4.13 METHOD OF APPLICATION:

I. If the contractor is a proprietary firm, the application shall be signed by the proprietor above his full typewritten name and the full name of his firm with its current address.

II. If the contractor is a firm in partnership, the application shall be signed by all the partners of the firm above their full typewritten names and current addresses or alternatively by a partner holding power of attorney for the firm. In the latter case a certified copy of the power of attorney shall accompany the application. In both cases a certified copy of the partnership deed and current address of all the partners of the firm shall accompany the application.

III. If the contractor is a limited company, the application shall be signed by a duly authorized person holding power of attorney for signing the application accompanied by a certified copy of the power of attorney. The contractor shall also furnish a copy of the Memorandum & Articles of Association duly attested by a Public Notary.

4.14 FINAL DECISION-MAKING AUTHORITY:

Director, IIM Bangalore reserves the right to accept or reject any application, to annul the pre-qualification process and reject all applications at any time, without assigning any reason or incurring any liability to the contractors. IIM Bangalore reserves the right to reject any or all prospective contractors without assigning any reason and to restrict the list of pre-qualified contractors to any number deemed suitable.

4.15 PARTICULARS PROVISIONAL

The particulars of the work given in “Sl.no.3” are provisional They are liable to change and must be considered only as advance information to assist the contractor to apply for proposed work.

4.16 SITE VISIT:

The contractor is advised to visit the site of work, at his own cost, and examine it and its surroundings by himself, collect all information that he considers necessary for proper assessment of the prospective assignment. Geo-technical Investigation report on random locations are furnished for reference.

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4.17 TECHNICAL CRITERIA

A	**i)Registration:** Class-III registered contractors with CPWD /KPWD /MES/Railways / Any Government Departments/Public Sector Undertakings/SEZ/ who fulfil the following requirements. shall be eligible to apply. ii) MSME Registration of Company/ firm iil)The contractor shall have satisfactorily completed following Magnitude of works (Including Civil Electrical & HVAC Works put together, any one option out of three options given here under) during last seven (7) years commencing from **1.04.2016** and ending on **31.03.2023 (**in the last 7 years ending on the last day of the month previous to the one in which the tenders are invited):
	AND
B	**Work Experience:** Intending tenderer should have completed satisfactorily following works during last Seven years i.e after 1.04.2016, in India as below: - **(a)** One Similar work costing not less than 1.30 crores including GST. **OR** **(b)** Two Similar works costing not less than 0.97 crores each, including GST. **OR** **(c)** Three Similar works costing not less than 0.65 crores each, including GST.
	AND
C	**Bid Capacity:** Intending tenderer, who meet the minimum qualification criteria will be qualified, only if, their available bid capacity is more than the total bid value. The available bid capacity will be calculated as under: Assessed Available Bid capacity = (A*N*2 - B), where A = Maximum value of works executed in any one year during the last five years (updated to 2022-23 price level) taking into account the completed as well as works in progress. N = Number of years prescribed for completion of the works for which bids are invited. B = Value of existing commitments and on-going works to be completed during the next two years.
	AND
D	**Financial Turnover:** Tenderer have average financial turnover of Rs 0.80 cr on Construction works during the last three years ending 31 th March 2023.
E	**Certified CA Net-worth Certificate or Banker Certificate:** Intending tenderer should have a certified CA Net-worth or Banker Certificate of Rs 0.80 Cr. The Banker certificates shall not be older than 3 months from the last date of submission of bid.
F	**Loss making entity:** Intending tenderer should not have incurred any loss in more than two years during the last five financial years ending 31st March 2023.

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Similar work shall means exposed insitu/precast concrete panels executed for building/other infrastructure works will be considered.

(a) All tenderers should submit the valid GST registration certificate. Commercial tax certificate,

(b) balance sheet with profit and loss statement for the five financial years ending 31st March 2023.

I. The tenderers shall also submit satisfactory completion certificates in support of each quoted experience along with work order. The satisfactory completion certificate should be signed by an officer not below the rank of Executive Engineer concerned in case of Government department or the rank of General Manager in case of public sector as the case may be. In case of work from reputed private organizations, the copy of agreement, work order and the TDS Certificates shall be submitted along with the work completion certificate duly signed by the architect and client both.

II. The bidder shall submit the certificates in respect of all ongoing/in-hand works to be signed by an officer not below the rank of Executive Engineer concerned in case of Government department or the rank of General Manager in case of public sector as the case may be. A consolidated list of all such works shall be submitted by the bidder.

III. Application from joint ventures and consortiums are not accepted.

IV. The contractor must submit an undertaking that the contractor is not in default of payment of Statutory dues (other than disputed dues being contested by the contractor) and that up to tax returns have been filed along with the payment of due taxes, and submit copies of such returns submitted to the IT department/ Department of Trade and Taxes.

V. Should not be blacklisted by any State/Central Govt. Department or PSU or Autonomous bodies. The contractor must submit a duly notarized affidavit to this effect.

VI. Applications received without this declaration in original shall (Scan Copy) stand automatically rejected.

4.18 DESIRABLE CRITERIA:

It is desirable that the contractor does not have any litigation(s) in process. The contractor must submit information of on-going litigations and the history of concluded litigations in the past seven years, duly highlighting litigations arising from the construction contracts. If the contractor has no litigations either in process or in the past 7 years, an affidavit to this effect, duly notarized must be submitted in original. For all the pending litigation for construction contracts, it shall in total not represent more than 20% (twenty percent) of the contractor's net worth and an affidavit to this effect duly notarized must be submitted in original.

I. For all the purposes, cost of work shall mean gross value of the completed work including the cost of materials supplied by the Govt. /Client but excluding those supplied free of cost. If customer supplied free of cost material is added in cost of work, due supporting documents, regarding the cost of material from client, should be submitted.

4.19 ESSENTIAL SUBMISSIONS AND INFORMATION:

I. The bidder shall provide copies of work orders as well as completion certificates from the Employer as documentary proof for having executed similar works. However, decision with regard to eligibility of the contractor will be taken by the Employer, only after necessary documents provided by the contractor have been examined.

Signature of the contractor with seal

II. The contractor's performance for each work completed in the last Seven years and works in hand shall be certified by an officer not below the rank of Executive Engineer or equivalent and shall be obtained in sealed cover.

III. The contractor must submit an undertaking that the contractor is not in default of payment of Statutory dues (other than disputed dues being contested by the contractor) and that up to tax returns have been filed along with the payment of due taxes, and submit copies of such returns submitted to the IT department/ Department of Trade and Taxes.

IV. The contractor shall own construction equipment as per list required for the proper and timely execution of the work. Else, he shall certify that he would be able to manage the equipment by hiring etc. and submit the list of firms from whom he proposes to hire. Details of any plant / equipment required for the work need to be indicated. Facilities of field lab and test equipment shall also be furnished.

V. The contractor shall have sufficient number of Technical and Administrative employees for the proper execution of the contract work. The contractor shall submit the organization chart along with a list of the employees stating clearly how they would be involved in this work.

VI. Minimum requirement of Technical Staff for this work furnished as under which shall be assessed for evaluation:

VII. Contractor shall submit the supporting Documents such as:

VIII. List of full time Technical staff he proposes to deploy against the work with name qualification and experience each along with complete CV.

IX. Attested copies of Degree/Diploma & Experience certificate.

X. Declaration from the Technical staff that they are employed with the contractor

XI. Documents like PF subscription, copy of Income Tax return with IT Form 16

XII. The contractor needs to make disclosure of any liquidated damages or penalties imposed on it by the customers towards delay in completion of the project or for not meeting the contractual specifications, including issues relating to defects, workmanship and warranty obligations.

XIII. The contractor will be required to give an undertaking that it would comply with all statutory laws and compliances, including those applicable to the subcontractors appointed by him and indemnify the Institute of all implications and consequences resulting from any non-compliances due to any reasons whatsoever.

Signature of the contractor with seal

4.20 EVALUATION CRITERIA FOR PRE-QUALIFICATION:

S.N	Attributes	Maximum Marks	Evaluation
(a)	Financial strength (Form "A" and "B")	Maximum 20 Marks	i)60% marks for minimum eligibility criteria (ii) 100% marks for twice the minimum eligibility criteria or more In between (i) & (ii) – on pro-rata basis
	A : Turn Over (Form A)	16 Marks	
	B: Solvency (form B)	4 Marks	
(b)	Experience in similar nature of Work during last Seven years 1.04.2016 to 31.03.2023(Form C).	Maximum 30 Marks	(i) 60% marks for minimum eligibility criteria (ii) 100% marks for twice the minimum eligibility criteria or more In between (i) & (ii) – on pro-rata basis
(c)	Performance on works (Form E)		
	1) Performance on Time Over run (ToR)	Maximum 20 Marks	
	Parameter Calculation for Points If ToR = (I)Without Levy of compensation II)With Levy of compensation III) Levy of compensation not decided	1.00 2.00 3.00 20 15 10 20 5 0 - 20 10 0	
	TOR = AT/ST, where AT=Actual Time; ST=Stipulated Time. Note: Marks for value in between the stages indicated above is to be determined by straight line Variation basis.		
	2).Performance on Work Quality (form E)	Maximum 15 Marks	
	i)very good ii)good iii)Fair iv) poor	15Marks 10Marks 05Marks 0 Marks	
	Note: Weight age of 20% shall be given to the certificate furnished by the Agency (Form E) and 80% to the performance report given by the committee after evaluation of the quality based on physical inspection of the work, as deemed necessary and appropriated by the said committee.		
(d)	Personal and Establishment (Form G)	Maximum 5 Marks	

Sl. No	Designation (Technical Representative)	Educational and Relevant Experience	Maximum Marks
1	Project Manager	Graduate in Civil Engg. With Minimum 10 to 15 yrs. of experience in the construction management, and supervision of Civil works with minimum 8 years' experience as a project manager	5

(e)	Plant & Equipment (Form H)	Maximum 10 Marks	

Sr. No	Plant & Equipment	Maximum marks
1	Rollers of 5 T Capacity	Maximum Marks 5
2	R 800 Concrete Mixer Machine	Maximum Marks 3
3	Vibration Compactor	Maximum Marks 2

	Total	100 marks

Signature of the contractor with seal

To be eligible for short listing the bidder must secure at least 50% in each and 60% marks in aggregate. IIMB however, reserves the right to restrict the list of bidders qualifying in technical bid evaluation to any number, as deemed suitable by it

4.21 Tender Submission:

I. Bidder submit Technical & Financial bids through The CPP portal within the stipulated within date & Time

II. IIM Bangalore, reserves the right, without being liable for any damages or obligation or informs the contractor, to:

a) Amend the scope of work and/or value of contract to the contractor.
b) Amend the time for execution of work.
c) Reject any or all the applications without assigning any reason.

III. Any effort on the part of the contractor or his agent to exercise influence or to pressurize the employer would result in automatic rejection of his application. Canvassing of any kind is strictly prohibited.

4.22 TENDER FORMAT FOR EXECUTION OF WORKS

All Work shall be executed according to the Tender Document comprising of general conditions of contract, technical specification and Bill of Quantities .IIM Bangalore reserves the right to modify any of the conditions to suit to its specific requirements.

4.23 MISCELLANEOUS

i. The Bidding Process shall be governed by, and construed in accordance with, the laws of India and the Courts in Bangalore (state of Karnataka) shall have exclusive jurisdiction over all disputes arising under, pursuant to and/ or in connection with the Bidding Process.

ii. IIM Bangalore, in its sole discretion and without incurring any obligation or liability, reserves the right, at any time, to;

a) suspend and/ or cancel the Bidding Process and/ or amend and/ or supplement the Bidding Process or modify the dates or other terms and conditions relating thereto;
b) consult any Contractor in order to receive clarification or further information;
c) pre-qualify or not to pre-qualify any Contractor and/ or to consult any Contractor in order to receive clarification or further information;
d) retain any information and/ or evidence submitted to the Authority by, on behalf of, and/ or in relation to any Contractor; and/ or
e) Independently verify, disqualify, reject and/ or accept any and all submissions or other information and/ or evidence submitted by or on behalf of any Contractor.
f) Call for information from previous clients and evaluate the previous completed projects regarding all submission including litigations.
g) Undertake physical verification of completed projects and interact with clients.
h) Call for information from taxation authority or by financial auditor, banker, charted accountant engaged by the contractor.
i) decide on the magnitude and scope of work before commencement of the project work

Signature of the contractor with seal

iii. It shall be deemed that by submitting the Application, the Contractor agrees and releases the Authority, its employees, agents and advisers, irrevocably, unconditionally, fully and finally from any and all liability for claims, losses, damages, costs, expenses or liabilities in any way related to or arising from the exercise of any rights and/ or performance of any obligations hereunder and the Bidding Documents, pursuant hereto, and/ or in connection with the Bidding Process, to the fullest extent permitted by applicable law, and waives any and all rights and/ or claims it may have in this respect, whether actual or contingent, whether present or in future.

iv. Any addendum/change in the schedule will be uploaded in CPP portal http://eprocure.gov.in/eprocure/app.and IIMB website only.

Signature of the contractor with seal

5. List of Documents to be attached.

SL. No.	List of forms	Form No.
1	Financial information	Form A
2	Form of bankers' solvency certificate from a scheduled bank	Form B
	Details of all works of similar nature completed during the last seven years 1.04.2016 to 31.03.2023.	Form C
3	Projects under execution or awarded	Form D
4	Performance report of works to be considered for eligibility	Form E
5	Structure & organization	Form F
7	Details of technical & administrative personnel to be employed for the work	Form G
8	Details of construction and equipment likely to be used in carrying out the work	Form H
9	Tenderer's information sheet	Form I
10	Declaration	Form J
11	Calculation of bidding capacity	
12	Notarized affidavit of not been blacklisted by any state/Central departments /PSUs /Autonomous bodies during the last 7 years of its operations	
13	An undertaking that the Vendor is not in default of payment of Statutory dues	

Signature of the contractor with seal

FORM ‘A’

FINANCIAL INFORMATION

Name of the firm / contractor……..

I. Financial Analysis-Details to be furnished duly supported by figures in balance sheet / profit & loss account for the last three years duly certified and audited by the Chartered Accountants, as submitted by the applicant to the Income Tax Department (Copies to be attached).

Fig in Lakhs Rs

SL No	Particulars	Financial Years				
		2018-2019	2019-2020	2020-2021	2021-2022	2022-2023
1)	Gross Annual Turnover					
2)	Gross Annual Turnover on Construction Works					
3)	Profit/ Loss					

II . Financial arrangements for carrying out the proposed work.

SIGNATURE OF BIDDER(S)

Signature of Chartered Accountant with Seal

Signature of the contractor with seal

FORM ‘B’

FORM OF BANKERS’ SOLVENCY CERTIFICATE FROM A SCHEDULED BANK

This is to certify that to the best of our knowledge and information that M/s. / Shri …….. …….. having marginally noted address, a customer of our bank are / is respectable and can be treated as good for any engagement up-to a limit of Rs……... (Rupees ……)

This certificate is issued without any guarantee or responsibility on the bank or any of the officers.

(Signature)

For the Bank

NOTE:

I. Banker’s certificate should be on letter head of the Bank, sealed in cover addressed to Director IIMB, Bengaluru

II. In case of partnership firm, certificate should include names of all partners as recorded with the Bank.

III. The certificate should not be more than 6 months old from last date of receipt of eligibility bid and financial bid through e-tendering.

Signature of the contractor with seal

Form 'C'

DETAILS OF ALL WORKS OF SIMILAR NATURE COMPLETED DURING THE LAST SEVEN YEARS i.e. AFTER 1.04.2016

Name of the firm / Contractor ……...

Sl. No.	Name of work / project and location	Owner or sponsoring organization	Cost of work in crores	Date of commencement as per contract	Stipulated date of completion	Actual date of completion	Litigation/ arbitration cases pending / in progress with details*	Name and Address (Postal & Email) / Telephone number of officer to whom Reference may be made	Remarks
1	2	3	4	5	6	7	8	9	10

Certified that the above list of works is complete and no work has been left out and that the information given is correct to my / our knowledge and belief.

Note:The tenderers shall also submit satisfactory completion certificates in support of each quoted experience g with work order. The satisfactory completion certificate should be signed by an officer not below the rank of Executive Engineer concerned in case of Government department or the rank of General Manager in case of public sector as the case may be. In case of work from reputed private organizations, the copy of agreement, work order and the TDS Certificates shall be submitted along with the work completion certificate duly signed by the architect and client both.

SIGNATURE OF BIDDER(S)
WITH STAMP

Signature of the contractor with seal

*indicate gross amount claimed and amount awarded by the Arbitrator.

FORM ‘D’

PROJECTS UNDER EXECUTION OR AWARDED

Sl. No.	Name of work / project and location	Owner or sponsoring organization	Cost of work in Crores	Date of commencement as per contract	Stipulated date of completion	Up to date percentage progress of work	Slow progress if any, and reasons thereof	Name and Address (Postal & Email) / Telephone number of officer to whom Reference may be made	Remarks
1	2	3	4	5	6	7	8	9	10

SIGNATURE OF BIDDER(S)
WITH STAMP

Signature of the contractor with seal

FORM ‘E’

PERFORMANCE REPORT OF WORKS TO BE CONSIDERED FOR ELIGIBILITY

1	Name of work / Project & Location	
2	Agreement No.	
3	Estimated Cost	
4	Tendered Cost	
5	Date of Start	
6	Date of completion	
	i) Stipulated Date of Completion (as mentioned in work order)	
	ii) Actual Date of Completion	
7	i) Status of Compensation/ Penalty (Not Levied / Levied / Not Decided)	
	ii) Amount of compensation levied for delayed completion, if any	
8	Amount of reduced rate items, if any.	
9	Whether any litigation / arbitration case pending / in progress in respect of this work.	
10	Total Value of work done	
11	Agreement amount	
12	a. Tentative value of various components of work executed : b. RCC framed building works including internal S/I, W/S and drainage. c. Curtain glazing works/structural glazing. d. Water proofing works. e. External water supply, Sanitary installation including Development works. f. Internal Electrical installations. g. External Electrical work(including sub stations /transformer /DG sets /Electrical cabling/street lighting etc.) h. External civil works including road work/storm water drain /culverts/utility crossing/sumps/OHT/STPs/WTPs etc i. For Fire fighting works j. External infrastructure works	
11	Performance Report	
	1) Quality of Work	Very Good/Good/Fair/Poor
	2) Financial Soundness	Very Good/Good/Fair/Poor
	3) Technical Proficiency	Very Good/Good/Fair/Poor
	4) Resourcefulness	Very Good/Good/Fair/Poor
	5) General Behaviour	Very Good/Good/Fair/Poor
12	Remarks (if any):	
	Dated:	Executive Engineer Or Equivalent with stamp

Signature of the contractor with seal

FORM ‘F’

STRUCTURE & ORGANISATION

1	Name & Address of the bidder	
2	Telephone No. / Email id /Telex No./Fax No.	
3 4	Legal status of the bidder (attach copies of original document defining the legal status).	
	a) An Individual	
	b)A proprietary firm	
	c)A firm in partnership	
	d)A limited company or Corporation	
4	Particulars of registration with various Government bodies (attach attested photo-copy).	
	ORGANIZATION/PLACE OF REGISTRATION	
	1.	
	2.	
	3.	
5	Names and Titles of Directors & Officers with Designation to be concerned with this work.	
6	Designation of individuals authorized to act for the Organization.	
	Was the bidder ever required to suspend construction for a period of more than six months continuously after commencing the construction? If so, given the name of the project and reasons of suspension of work.	
7	Has the bidder, or any constituent partner in case of partnership firm, ever abandoned the awarded work before its completion? If so, give name of the project and reasons for abandonment.	
8	Has the bidder, or any constituent partner in case of partnership firm, ever been debarred/ black listed for tendering in any organization at any time? If so, give details	
9	Has the bidder, or any constituent partner in case of partnership firm, ever been convicted by a court of law? If so, give details.	
10	In which field of Civil Engineering Construction the bidder has specialization and interest?	
11	Any other information considered necessary but not included above.	

Signature of the contractor with seal

FORM ‘G’

DETAILS OF TECHNICAL & ADMINISTRATIVE PERSONNEL TO BE EMPLOYED FOR THE WORK

Sl. No.	Designation	Total Number	Number for this work	Name	Qualifications	Professional/ Construction Experience and details of work carried out	How these would be involved in this work	Remarks
1	2	3	4	5	6	7	8	9

Signature of bidder(s) with stamp

Signature of the contractor with seal

FORM 'H'

DETAILS OF CONSTRUCTION AND EQUIPMENT LIKELY TO BE USED IN CARRYING OUT THE WORK

Sl.no	Name of Equipments	Nos	Capacity or Type	Age	Conditions	Owner Ship Status			Current location	Remarks
						Presently Owned	Leased	To be Purchased		
1	2	3	4	5	6	7	8	9	10	11
1	Over Head Cranes									
2	Excavators									
3	Vibrator Compactor.									

I, the undersigned, do hereby undertake that our firm M/s. …… shall deploy all plants, equipment's and Machineries required for implementation of the project as per technical specifications. I also undertake to either own or have assured access through hire or lease the key items of the equipment's as specified in this form.

Signed by an Authorized Officer of the firm With stamp

Signature of the contractor with seal

FORM 'I'

TENDERER'S INFORMATION SHEET

Tenderer's Information		
Tenderer's legal name		
Tenderer's legal address		
Tenderer's authorized representative (name, address, telephone numbers, fax numbers, e-mail address)	Name: Telephone : Fax :	Address: E-Mail:
Tenderer's details of Incorporation	Place of incorporation/ registration:	Year of incorporation:
Attached are copies of the following original documents.		
❑ 1. Articles of incorporation or constitution of the legal entity named above. ❑ 2. In the case of government-owned entity, documents establishing legal and financial autonomy and compliance with commercial law.		

Details of the office closest to Bengaluru(if available)

1.	Address of Office	
2.	Telephone :	Contact :
3.	Fax :	E-Mail :

Signature of bidder(s) with stamp

Designation: ----------

Signature of Contractor……..... Signature of Employer…… ……..

Signature of the contractor with seal

FORM ‘J’

DECLARATION

(*TO BE SIGNED BY THE TENDERER SUBMITTING THE TENDR*

ON DOWNLOADED TENDER DOCUMENT)

I/We hereby declare and certify that:

1. I/We are submitting the tender in the tender document downloaded by me /us from the website & we certify that there is no change in formatting, numbering of pages etc. In the downloaded documents.
2. I/We are submitting the tender in the tender document which is exactly similar and identical to the one available on the website and also as available with the officer inviting tenders.
3. I / We have not made any modifications / corrections / additions / omissions etc in the tender documents downloaded from web by me / us.
4. I / We have checked that no page in the downloaded tender document is missing and all the pages as per web site are available & that all the pages of tender document submitted by us are clear & legible.
5. I / We have signed (with stamp) all the pages of the tender document before submitting the same.
6. I / we have wax sealed the tender documents properly before submitting the same.
7. I / We have submitted the application for issue of tender documents on the prescribed format separately along with the cost of tender documents and also the attested Xerox copies of the eligibility documents prescribed for respective work in the NIT.
8. I / We have read carefully & understood the entire Tender document including important instructions to the tenderers submitting the downloaded tender.
9. In case at any stage whatsoever at a later date it is found/ revealed that there is a difference in our downloaded tender documents from the original approved Tender Document, IIMB shall have the absolute right to take any action as deemed fit without any prior intimation to me / us.
10. In case at any stage whatsoever at a later date it is found that there is difference in our downloaded tender document from the approved Tender Document, we clearly understand that our work shall be liable to be cancelled and debarred for bidding in IIM Bengaluru in future forever and in such an eventuality I / We shall have no right or claim for any damages / compensation from IIMB on this account. Further in such case I / We may also be debarred by IIMB for further participation in the tendering in the concerned IIMB& be removed from the approved list of contractors of IIMB

Dated…… Signature of bidder(s) with stamp

6.GENERAL CONDITION OF CONTRACT

1. The **Contract** means the documents forming the tender and acceptance thereof and the formal agreement executed between the competent authority on behalf of the Director of IIMB and the Contractor, together with the documents referred to therein including these conditions, the specifications, designs, drawings and instructions issued from time to time by the Engineer-in-Charge and all these documents taken together, shall be deemed to form one contract and shall be complementary to one another.

2. In the contract, the following expressions shall, unless the context otherwise requires, have the meanings, hereby respectively assigned to them: -

i. The expression **works** or **work** shall, unless there be something either in the subject or context repugnant to such construction, be construed and taken to mean the works by or by virtue of the contract contracted to be executed whether temporary or permanent, and whether original, altered, substituted or additional.

ii. The **Site** shall mean the land, places on, into or where work is to be executed under the contract or any adjacent land, path, or street or where work is to be executed under the contract or any adjacent land, path or street which may be temporally allotted or used for the purpose of carrying out the contract.

iii. The **Contractor** shall mean the individual, 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. The Director means the Director of IIMB and his successors.

v. The Project Manager/Engineer-in-charge means who shall supervise and be in-charge of the works.

vi. Indian Institute of Management- Bangalore shall mean the Director IIMB.

vii. Accepting Authority shall mean the authority mentioned in Schedule ‘F’.

viii. **Excepted Risk** are risks due to riots (other than those on account of contractor's employees), war (whether declared or not) invasion, act of foreign enemies, hostilities, civil war, rebellion revolution, insurrection, military or usurped power, any acts of Government, damages from aircraft, acts of God, such as earthquake, lightening and unprecedented floods, and other causes over which the contractor has no control and accepted as such by the Accepting Authority or causes solely due to use or occupation by Government of the part of the works in respect of which a certificate of completion has been issued or a cause solely due to Government's faulty design of works.

ix. **Market Rate** shall be the rate as decided by the Engineer-in-Charge on the basis of the cost of materials and labour at the site where the work is to be executed plus the percentage mentioned in Schedule 'F' to cover, all overheads and profits.

x. Provided that no extra overheads and profits shall be payable on the part(s) of work assigned to other agency(s) by the contractor as per terms of contract.

CLAUSES OF CONTRACT

CLAUSE 1

Performance Guarantee

i) The contractor shall submit an irrevocable Performance Guarantee of 5%(Five Percentage)tendered amount in addition to other deposits mentioned elsewhere in the contract for his proper performance of the contract agreement, (not withstanding and/or without prejudice to any other provisions in the contract) within period specified in Schedule 'F' from the date of issue of letter of acceptance. This period can be further extended by the Project Manager up to a maximum period as specified in schedule 'F' on written request of the contractor stating the reason for delays in procuring the Performance Guarantee, to the satisfaction of the Project Manager. This guarantee shall be in the form of Cash (in case guarantee amount is less than Rs. 10,000/-) or Deposit at Call receipt of any scheduled bank/Banker's Cheque of any scheduled bank/Demand Draft of any scheduled bank/Pay Order of any scheduled bank (in case guarantee amount is less than Rs. 1,00,000/-) or IIMB Securities or Fixed Deposit Receipts or Guarantee Bonds of any Scheduled Bank or the State Bank of India in accordance with the form annexed hereto. In case a fixed deposit receipt of any Bank is furnished by the contractor to the IIMB as part of the performance guarantee and the Bank is unable to make payment against the said fixed deposit receipt, the loss caused thereby shall fall on the contractor and the contractor shall forthwith on demand furnish additional security to the IIMB to make good the deficit.

ii) The Performance Guarantee shall be initially valid up to the stipulated date of completion plus 60 days beyond that. In case the time for completion of work gets enlarged, the contractor shall get the validity of Performance Guarantee extended to cover such enlarged time for completion of work. After recording of the completion certificate for the work by the competent authority, the performance guarantee shall be returned to the contractor, without any interest. However, in case of contracts involving maintenance of building and services/any other work after construction of same building and services/other work, then 50% of Performance Guarantee shall be retained as Security Deposit. The same shall be returned year wise proportionately.

iii) The Project Manager shall not make a claim under the performance guarantee except for amounts to which the Director IIMB is entitled under the contract (not withstanding and/or without prejudice to any other provisions in the contract agreement) in the event of:

a) Failure by the contractor to extend the validity of the Performance Guarantee as described herein above, in which event the Project Manager may claim the full amount of the Performance Guarantee.

b) Failure by the contractor to pay Director IIMB any amount due, either as agreed by the contractor or determined under any of the Clauses/Conditions of the agreement, within 30 days of the service of notice to this effect by Project Manager.

c) In the event of the contract being determined or rescinded under provision of any of the Clause/Condition of the agreement, the performance guarantee shall stand forfeited in full and shall be absolutely at the disposal of the Director IIMB.

d) On substantial Completion of any work which has been completed to such an extent that the intended purpose of the work is met and ready to use, then a provisional Completion certificate shall be recorded by the Project Manager. The provisional certificate shall have appended with a list of outstanding balance item of work that need to be completed in accordance with the provisions of the contract.

This provisional completion certificate shall be recorded by the concerned Project Manager.

After recording of the provisional Completion Certificate for the work by the competent authority, the 80 % of performance guarantee shall be returned to the contractor, without any interest.

However in case of contracts involving Maintenance of building and services / any other work after construction of same building and services/ other work, then 40% of performance guarantee shall be returned to the contractor, without any interest after recording the provisional Completion certificate.

CLAUSE 1 A

Recovery of Security Deposit

The person/persons whose tender(s) may be accepted (hereinafter called the contractor) shall permit IIMB at the time of making any payment to him for work done under the contract to deduct a sum at the rate of 5% of the gross amount of each running and final bill till the sum deducted will amount to security deposit of 5% of the tendered value of the work. Such deductions will be made and held by IIMB by way of Security Deposit unless he/they has/have deposited the amount of Security at the rate mentioned above in cash or in the form of IIMB Securities or fixed deposit receipts. In case a fixed deposit receipt of any Bank is furnished by the contractor to the IIMB as part of the security deposit and the Bank is unable to make payment against the said fixed deposit receipt, the loss caused thereby shall fall on the contractor and the contractor shall forthwith on demand furnish additional security to the IIMB to make good the deficit.

All compensations or the other sums of money payable by the contractor under the terms of this contract may be deducted from, or paid by the sale of a sufficient part of his security deposit or from the interest arising therefrom, or from any sums which may be due to or may become due to the contractor by IIMB on any account whatsoever and in the event of his Security Deposit being reduced by reason of any such deductions or sale as aforesaid, the contractor shall within 10 days make good in cash or fixed deposit receipt tendered by the State Bank of India or by Scheduled Banks or IIMB Securities (if deposited for more than 12 months) endorsed in favor of the Project Manager, any sum or sums which may have been deducted from, or raised by sale of his security deposit or any part thereof. The security deposit shall be collected from the running bills and the final bill of the contractor at the rates mentioned above.

The security deposit as deducted above can be released against bank guarantee issued by a scheduled bank, on its accumulations to a minimum of Rs. 5 lac subject to the condition that amount of such bank guarantee, except last one, shall not be less than Rs. 5 lac. Provided further that the validity of bank guarantee including the one given against the earnest money shall be in conformity with provisions contained in clause 17 which shall be extended from time to time depending upon extension of contract granted under provisions of clause 2 and clause 5.

In case of contracts involving maintenance of building and services/any other work after construction of same building and services/other work, then 50% of Performance Guarantee shall be retained as Security Deposit. The same shall be returned year wise proportionately.

Note-1: IIMB papers tendered as security will be taken at 5% (five per cent) below its market price or at its face value, whichever is less. The market price of IIMB paper would be ascertained by the PMC Project Manager at the time of collection of interest and the amount of interest to the extent of deficiency in value of the IIMB paper will be withheld if necessary.

Note-2: IIMB Securities will include all forms of Securities mentioned in Rule No. 274 of the G.F. Rules except fidelity bond. This will be subject to the observance of the condition mentioned under the rule against each form of security.

Note-3: Note 1 & 2 above shall be applicable for both clause 1 and 1A

CLAUSE 2

Compensation for Delay

If the contractor fails to maintain the required progress in terms of clause 5 or to complete the work and clear the site on or before the contract or justified extended date of completion, as per clause 5 (excluding any extension under Clause 5.5) as well as any extension granted under clauses 12 and 15, he shall, without prejudice to any other right or remedy available under the law to the IIMB on account of such breach, pay as agreed compensation the amount calculated at the rates stipulated below as the authority specified in schedule 'F' may decide on the amount of Tendered Value of the work for every completed day/month (as determined) that the progress remains below that specified in Clause 5 or that the work remains incomplete.

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

(i) Compensation	@ 1 % 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 Tendered Value of work or of the Tendered Value of the Sectional part of work as mentioned in Schedule 'F' for which a separate period of completion is originally given.

In case no compensation has been decided by the authority in Schedule 'F' during the progress of work, this shall be no waiver of right to levy compensation by the said authority if the work remains incomplete on final justified extended date of completion. If the Project Manager decides to give further extension of time allowing performance of work beyond the justified extended date, the contractor shall be liable to pay compensation for such extended period. If any variation in amount of contract takes place during such extended period beyond justified extended date and the contractor becomes entitled to additional time under clause 12, the net period for such variation shall be accounted for while deciding the period for levy of compensation. However, during such further extended period beyond the justified extended period, if any delay occurs by events under sub clause 5.2, the contractor shall be liable to pay compensation for such delay.

Provided that compensation during the progress of work before the justified extended date of completion for delay under this clause shall be for non-achievement of sectional completion or part handing over of work on stipulated/justified extended date for such part work or if delay affects any other works/services. This is without prejudice to right of action by the Project Manager under clause 3 for delay in performance and claim of compensation under that clause.

In case action under clause 2 has not been finalized and the work has been determined under clause 3, the right of action under this clause shall remain post determination of contract but levy of compensation shall be for days the progress is behind the schedule on date of determination, as assessed by the authority in Schedule F, after due consideration of justified extension. The compensation for delay, if not decided before the determination of contract, shall be decided after of determination of contract.

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 IIMB. In case, the contractor does not achieve a particular milestone mentioned in schedule F, or the re-scheduled milestone(s) in terms of Clause 5.4, the amount shown against that milestone shall be withheld, to be adjusted against the compensation levied as above. 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.

CLAUSE 2A

Incentive for early completion

In case, the contractor completes the work ahead of stipulated date of completion or justified extended date of completion as determined under clauses 5.3, 12 & 15, a bonus @ 2% (two per cent) of the tendered value per month computed on per day basis, shall be payable to the contractor, subject to a maximum limit of 5% (five per cent) of the tendered value. Provided that justified time for extra work shall be calculated on pro-rata basis as cost of extra work X stipulated period /tendered value. The amount of bonus, if payable, shall be paid along with final bill after completion of work. Provided always that provision of the Clause 2A shall be applicable only when so provided in 'Schedule F'.

CLAUSE 3

When Contract can be Determined

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

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

(ii) If the contractor has, without reasonable cause, suspended the progress of the work or has failed to proceed with the work with due diligence and continues to do so after a notice in writing of seven days from the Project Manager.

(iii) If the contractor fails to complete the work or section of work with individual date of completion on or before the stipulated or justified extended date, on or before such date of completion; and the Project Manager without any prejudice to any other right or remedy under any other provision in the contract has given further reasonable time in a notice given in writing in that behalf as either mutually agreed or in absence of such mutual agreement by his own assessment making such time essence of contract and in the opinion of Project Manager the contractor will be unable to complete the same or does not complete the same within the period specified.

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

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

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

(vii) If the contractor had secured the contract with IIMB as a result of wrong tendering or other non-bonafide methods of competitive tendering or commits breach of Integrity Agreement.

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

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

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

(xi) If the contractor assigns, (excluding part(s) of work assigned to other agency(s) by the contractor as per terms of contract), transfers, sublets (engagement of labor on a piece-work basis or of labor with materials not to be incorporated in the work, shall not be deemed to be subletting) or otherwise parts with or attempts to assign, transfer, sublet or otherwise parts with the entire works or any portion thereof without the prior written approval of the Project Manager.

When the contractor has made himself liable for action under any of the cases aforesaid, the Project Manager on behalf of the Director IIMB shall have powers:

(a) To determine the contract as aforesaid so far as performance of work by the Contractor is concerned (of which determination notice in writing to the contractor under the hand of the Project Manager shall be conclusive evidence). Upon such determination, the Earnest Money Deposit Security Deposit already recovered and Performance Guarantee under the contract shall be liable to be forfeited and shall be absolutely at the disposal of the IIMB.

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

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

CLAUSE 3A

In case, the work cannot be started due to reasons not within the control of the contractor within 1/8th of the stipulated time for completion of work or one month whichever is more, either party may close the contract by giving notice to the other party stating reasons. In such eventuality, the Performance Guarantee of the contractor shall be refunded within following time limits:

(i) If the Tendered value of work is up to Rs. 45 lac : 15 days.

(ii) If the Tendered value of work is more than Rs. 45 lac and

up to Rs. 2.5 Crore : 21 days.

(iii) If the Tendered value of work exceeds Rs. 2.5 Crore : 30 days.

Neither party shall claim any compensation for such eventuality. This clause is not applicable for any breach of the contract by either party.

CLAUSE 4

Contractor liable to pay Compensation even if action not taken under Clause 3

In any case in which any of the powers conferred upon the Project Manager by Clause-3 thereof, shall have become exercisable and the same are not exercised, the non-exercise thereof shall not constitute a waiver of any of the conditions hereof and such powers shall notwithstanding be exercisable in the event of any future case of default by the contractor and the liability of the contractor for compensation shall remain unaffected. In the event of the Project Manager putting in force all or any of the powers vested in him under the preceding clause he may, if he so desires after giving a notice in writing to the contractor, take possession of (or at the sole discretion of the Project Manager which shall be final and binding on the contractor) use as on hire (the amount of the hire money being also in the final determination of the Project Manager) all or any tools, plant, materials and stores, in or upon the works, or the site thereof belonging to the contractor, or procured by the contractor and intended to be used for the execution of the work/or any part thereof, paying or allowing for the same in account at the contract rates, or, in the case of these not being applicable, at current market rates to be certified by the Project Manager, whose certificate thereof shall be final, and binding on the contractor, clerk of the works, foreman or other authorized agent to remove such tools, plant, materials, or stores from the premises (within a time to be specified in such notice) and in the event of the contractor failing to comply with any such requisition, the Project Manager may remove them at the contractor's expense or sell them by auction or private sale on account of the contractor and his risk in all respects and the certificate of the Project Manager as to the expenses of any such removal and the amount of the proceeds and expenses of any such sale shall be final and conclusive against the contractor.

CLAUSE 5

Time and Extension for Delay

The time allowed for execution of the Works as specified in the Schedule 'F' 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 schedule 'F' or from the date of handing over of the site notified by the Project Manager, whichever is later. However, the handing over of site by the Project Manager in full or in part (if so provided in contract), shall be completed within two months from issue of acceptance letter. If the Contractor commits default in commencing the execution of the work as aforesaid, the performance guarantee shall be forfeited by the Project Manager and shall be absolutely at the disposal of the IIMB without prejudice to any other right or remedy available in law.

5.1. As soon as possible but within twenty one days of award of work and in consideration of
a) Schedule of handing over of site as specified in the Schedule 'F'

b) Schedule of issue of designs as specified in the Schedule 'F'

i. The Contractor shall submit a Time and Progress Chart for each mile stone. The Project Manager may within 30 days thereafter, if required modify, and communicate the program approved to the contractor failing which the program submitted by the contractor shall be deemed to be approved by the Project Manager. The work programme shall include all details of balance drawings and decisions required to complete the contract with specific dates by which these details are required by contractor without causing any delay in execution of the work. 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 Project Manager 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 Schedule 'F'.

ii. In case of non-submission of construction programme by the contractor the program approved by the Project Manager shall be deemed to be final.

iii. The approval by the Project Manager of such programme shall not relieve the contractor of any of the obligations under the contract.

iv. The contractor shall submit the Time and Progress Chart and progress report using the mutually agreed software or in other format decided by Project Manager for the work done during previous month to the Project Manager on or before 5th day of each month failing which a recovery Rs. 2500/ - (for works costing up to Rs. 20 Crores) / Rs. 5000/- (for works costing more than Rs. 20 Crores) shall be made on per week or part basis in case of delay in submission of the monthly progress report.

5.2. If the work(s) be delayed by:-

5.2.1. force majeure, or

5.2.2. abnormally bad weather, or

5.2.3. serious loss or damage by fire, or

5.2.4. civil commotion, local commotion of workmen, strike or lockout, affecting any of the trades employed on the work, or

5.2.5. delay on the part of other contractors or tradesmen engaged by Project Manager in executing work not forming part of the Contract, or

5.2.6. non-availability of stores, which are the responsibility of IIMB to supply or

5.2.7. non-availability or break down of tools and Plant to be supplied or supplied by IIMB or

5.2.8. Any other cause like above which, in the reasoned opinion of the Project Manager 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 Project Manager for entry in the hindrance register (physical or web-based as prescribed in Schedule 'F' 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 Project Manager to proceed with the works.

The contractor shall have no claim of damages for extension of time granted or rescheduling of milestone/s for events listed in sub clause 5.2.

5.3. In case the work is hindered by any reasons, in the opinion of the contractor, by the Department or for someone for whose action the Department is responsible, the contractor may immediately give notice thereof in writing to the Project Manager in the same manner as prescribed under sub Clause 5.2 seeking extension of time or rescheduling of milestone/s. The authority as indicated in Schedule 'F' shall, if justified, give a fair and reasonable extension of time and reschedule the mile stones for completion of work after due consideration of the same within 30 days of receipt of such request. In event of non-application by the contractor for extension of time Project Manager after affording opportunity to the contractor may give, supported with a programme, a fair and reasonable extension within a reasonable period of occurrence of the event.

Such extension of time or rescheduling of milestone/s shall be without prejudice to any other right or remedy of the parties in contract or in law; provided further that for concurrent delays under this sub clause and sub clause 5.2 to the extent the delay is covered under sub clause

5.2 The contractor shall be entitled to only extension of time and no damages.

5.4. Request for rescheduling of Mile stones or extension of time, to be eligible for consideration, shall be made by the Contractor in writing within fourteen days of the happening of the event causing delay on the prescribed forms i.e. Form of application by the contractor for seeking rescheduling of milestones (Appendix-XVI) or Form of application by the contractor for seeking extension of time (Appendix –XVII) respectively to the authority as indicated in Schedule 'F'. The Contractor shall indicate in such a request the period by which rescheduling of milestone/ s or extension of time is desired.

With every request for rescheduling of milestones, or if at any time the actual progress of work falls behind the approved programme by more than 10% of the stipulated period of completion of contract, the contractor shall produce a revised programme which shall include all details of pending drawings and decisions required to complete the contract and also the target dates by which these details should be available without causing any delay in execution of the work. A recovery as specified in Schedule 'F' shall be made on per day basis in case of delay in submission of the revised programme.

5.4.1. In any such case the authority as indicated in Schedule 'F' may give a fair and reasonable extension of time for completion of work or reschedule the mile stones. Such extension or rescheduling of the milestones shall be communicated to the Contractor by the authority as indicated in Schedule 'F' in writing, within 30 days of the date of receipt of such request from the Contractor in prescribed form. In event of non-application by the contractor for extension of time Project Manager after affording opportunity to the contractor may give, supported with a programme (as specified under 5.4 above), a fair and reasonable extension within a reasonable period of occurrence of the event.

5.5. In case the work is delayed by any reasons, in the opinion of the Project Manager, by the contractor for reasons beyond the events mentioned in clause 5.2 or clause 5.3 or clause 5.4 and beyond the justified extended date; without prejudice to right to take action under Clause 3, the Project Manager may grant extension of time required for completion of work without rescheduling of milestones. The contractor shall be liable for levy of compensation for delay for such extension of time.

CLAUSE 6

Measurements of Work Done

Project Manager shall, except as otherwise provided, ascertain and determine by measurement, the value in accordance with the contract of work done.

All measurement of all items having financial value shall be entered in Measurement Book and/or level field book so that a complete record is obtained of all works performed under the contract.

All measurements and levels shall be taken jointly by the Project Manager or his authorized representative and by the contractor or his authorized representative from time to time during the progress of the work and such measurements shall be signed and dated by the Project Manager and the contractor or their representatives in token of their acceptance. If the contractor objects to any of the measurements recorded, a note shall be made to that effect with reason and signed by both the parties.

If for any reason the contractor or his authorized representative is not available and the work of recording measurements is suspended by the Project Manager or his representative, the Project Manager and the Department shall not entertain any claim from contractor for any loss or damages on this account. If the contractor or his authorized representative does not remain present at the time of such measurements after the contractor or his authorized representative has been given a notice in writing three (3) days in advance or fails to countersign or to record objection within a week from the date of the measurement, then such measurements recorded in his absence by the Project Manager or his representative shall be deemed to be accepted by the Contractor.

The contractor shall, without extra charge, provide all assistance with every appliance, labor and other things necessary for measurements and recording levels.

Except where any general or detailed description of the work expressly shows to the contrary, measurements shall be taken in accordance with the procedure set forth in the specifications notwithstanding any provision in the relevant Standard Method of measurement or any general or local custom. In the case of items which are not covered by specifications, measurements shall be taken in accordance with the relevant standard method of measurement issued by the Bureau of Indian Standards and if for any item no such standard is available, then a mutually agreed method shall be followed.

The contractor shall give, not less than seven days' notice to the Project Manager or his authorized representative in charge of the work, before covering up or otherwise placing beyond the reach of measurement any work in order that the same may be measured and correct dimensions thereof be taken before the same is covered up or placed beyond the reach of measurement and shall not cover up and place beyond reach of measurement any work without consent in writing of the Project Manager or his authorized representative in charge of the work who shall within the aforesaid period of seven days inspect the work, and if any work shall be covered up or placed beyond the reach of measurements without such notice having been given or the Project Manager's consent being obtained in writing, the same shall be uncovered at the Contractor's expense, or in default thereof no payment or allowance shall be made for such work or the materials with which the same was executed.

Project Manager or his authorized representative may cause either themselves or through another Project Manager of the department to check the measurements recorded jointly or otherwise as aforesaid and all provisions stipulated herein above shall be applicable to such checking of measurements or levels.

It is also a term of this contract that recording of measurements of any item of work in the measurement book and/or its payment in the interim, on account or final bill shall not be considered as conclusive evidence as to the sufficiency of any work or material to which it relates nor shall it relieve the contractor from liabilities from any over measurement or defects noticed till completion of the defects liability period.

CLAUSE 6A

Computerized Measurement Book

Project Manager shall, except as otherwise provided, ascertain and determine by measurement the value of work done in accordance with the contract.

All measurements of all items having financial value shall be entered by the contractor and compiled in the shape of the Computerized Measurement Book having pages of A-4 size as per the format of the department so that a complete record is obtained of all the items of works performed under the contract.

All such measurements and levels recorded by the contractor or his authorized representative from time to time, during the progress of the work, shall be got checked by the contractor from the Project Manager or his authorized representative as per interval or program fixed in consultation with Project Manager or his authorized representative. After the necessary corrections made by the Project Manager, the measurement sheets shall be returned to the contractor for incorporating the corrections and for re-submission to the Project Manager for the dated signatures by the Project Manager and the contractor or their representatives in token of their acceptance.

Whenever bill is due for payment, the contractor would initially submit draft computerized measurement sheets and these measurements would be got checked/test checked from the Project Manager and/or his authorized representative. The contractor will, thereafter, incorporate such changes as may be done during these checks/test checks in his draft computerized measurements, and submit to the department a computerized measurement book, duly bound, and with its pages machine numbered. The Project Manager and/or his authorized representative would thereafter check this MB, and record the necessary certificates for their checks/test checks.

The final, fair, computerized measurement book given by the contractor, duly bound, with its pages machine numbered, should be 100% correct, and no cutting or over-writing in the measurements would thereafter be allowed. If at all any error is noticed, the contractor shall have to submit a fresh computerized MB with its pages duly machine numbered and bound, after getting the earlier MB cancelled by the department. Thereafter, the MB shall be taken in the PMC Office records, and allotted a number as per the Register of Computerized MBs. This should be done before the corresponding bill is submitted to the PMC Office for payment. The contractor shall submit two spare copies of such computerized MB's for the purpose of reference and record by the various Project Managers of the department.

The contractor shall also submit to the department separately his computerized Abstract of Cost and the bill based on these measurements, duly bound, and its pages machine numbered along with two spare copies of the "bill. Thereafter, this bill will be processed by the PMC Office and allotted a number as per the computerized record in the same way as done for the measurement book meant for measurements.

The contractor shall, without extra charge, provide all assistance with every appliance, labor and other things necessary for checking of measurements/levels by the Project Manager or his representative.

Except where any general or detailed description of the work expressly shows to the contrary, measurements shall be taken in accordance with the procedure set forth in the specifications notwithstanding any provision in the relevant Standard Method of measurement or any general or local custom. In the case of items which are not covered by specifications, measurements shall be taken in accordance with the relevant standard method of measurement issued by the Bureau of Indian Standards and if for any item no such standard is available then a mutually agreed method shall be followed.

The contractor shall give not less than seven days' notice to the Project Manager or his authorized representative in charge of the work before covering up or otherwise placing beyond the reach of checking and/or test checking the measurement of any work in order that the same may be checked and/or test checked and correct dimensions thereof be taken before the same is covered up or placed beyond the reach of checking and/or test checking measurement and shall not cover up and place beyond reach of measurement any work without consent in writing of the Project Manager or his authorized representative in charge of the work who shall within the aforesaid period of seven days inspect the work, and if any work shall be covered up or placed beyond the reach of checking and/or test checking measurements without such notice having been given or the Project Manager's consent being obtained in writing the same shall be uncovered at the Contractor's expense, or in default thereof no payment or allowance shall be made for such work or the materials with which the same was executed.

Project Manager or his authorized representative may cause either themselves or through another Project Manager of the department to check the measurements recorded by contractor and all provisions stipulated herein above shall be applicable to such checking of measurements or levels.

It is also a term of this contract that checking and/or test checking the measurements of any item of work in the measurement book and/or its payment in the interim, on account of final bill shall not be considered as conclusive evidence as to the sufficiency of any work or material to which it relates nor shall it relieve the contractor from liabilities from any over measurement or defects noticed till completion of the defects liability period.

CLAUSE 7

Payment on Intermediate Certificate to be regarded as Advances

No payment shall be made for work, estimated to cost Rs. One lac or less till after the whole of the work shall have been completed and certificate of completion given. For works estimated to cost over Rs. One lac, the interim or running account bills shall be submitted by the contractor for the work executed on the basis of such recorded measurements on the format of the Department in triplicate on or before the date of every month fixed for the same by the Project Manager. The contractor shall not be entitled to be paid any such interim payment if the gross work done together with net payment/ adjustment of advances for material collected, if any, since the last such payment is less than the amount specified in Schedule 'F', in which case the interim bill shall be prepared on the appointed date of the month after the requisite progress is achieved. Project Manager shall arrange to have the bill verified by

taking or causing to be taken, where necessary, the requisite measurements of the work. In the event of the failure of the contractor to submit the bills, no claims whatsoever due to delays on payment including that of interest shall be payable to the contractor. Payment on account of amount admissible shall be made by the Project Manager certifying the sum to which the contractor is considered entitled by way of interim payment at such rates as decided by the Project Manager. The amount admissible shall be paid by 10th working day after the day of presentation of the bill by the Contractor to the Project Manager or his representatives together with the account of the material issued by the department, or dismantled materials, if any. In the case of works outside the headquarters of the Project Manager, the period of ten working days will be extended to fifteen working days. In case of delay in payment of intermediate bills after 45 days of submission of bill by the contractor provided the bill submitted by the contractor found to be in order, a simple interest @ 10% per annum shall be paid to the contractor from the date of expiry of prescribed time limit which will be compounded on yearly basis.

All such interim payments shall be regarded as payment by way of advances against final payment only and shall not preclude the requiring of bad, unsound and imperfect or unskilled work to be rejected, removed, taken away and reconstructed or re-erected. Any certificate given by the Project Manager relating to the work done or materials delivered forming part of such payment, may be modified or corrected by any subsequent such certificate(s) or by the final certificate and shall not by itself be conclusive evidence that any work or materials to which it relates is/are in accordance with the contract and specifications. Any such interim payment, or any part thereof shall not in any respect conclude, determine or affect in any way powers of the Project Manager under the contract or any of such payments be treated as final settlement and adjustment of accounts or in any way vary or affect the contract.

Pending consideration of extension of date of completion, interim payments shall continue to be made as herein provided without prejudice to the right of the department to take action under the terms of this contract for delay in the completion of work, if the extension of date of completion is not granted by the competent authority.

The Project Manager in his sole discretion on the basis of a certificate from the representatives to the effect that the work has been completed up to the level in question make interim advance payments without detailed measurements for work done (other than foundations, items to be covered under finishing items) up to lintel level (including sunshade etc.) and slab level, for each floor working out at 75% of the assessed value. The advance payments so allowed shall be adjusted in the subsequent interim bill to be submitted by the contractor within 10 days of the interim payment. In case of delay in submission of bill by the contractor a simple interest @ 10% per annum shall be paid to the IIMB from the date of expiry of prescribed time limit which will be compounded on yearly basis.

Payments in composite Contracts

In case of composite tenders, running payment for the major component shall be made by Project Manager to the main contractor. Running payment for minor component shall be made by the Project Manager of the discipline of minor component directly to the main contractor.

In case main contractor fails to make the payment to the contractor associated by him within 15 days of receipt of each running account payment, then on the written complaint of contractor associated for such minor component, Project Manager of minor component shall serve the show cause to the main contractor and if reply of main contractor either not received or found unsatisfactory, he may make the payment directly to the contractor associated for minor component, as per the terms and conditions of the agreement drawn between main contractor and associate contractor fixed by him. Such payment made to the associate contractor shall be recovered by Project Manager of major or minor component from the next R/A/ final bill due to main contractor as the case may be.

CLAUSE 7A

No Running Account Bill shall be paid for the work till

a) Submission of the applicable labor licenses, registration with EPFO, ESIC and BOCW Welfare Board, CAR Policy, whatever applicable are submitted by the contractor to the Project Manager.

b) Till Submission of Submission for completion of all works as per tender within the tender period.

c) Signing of Taking over of site for construction purposes.

CLAUSE 7B:

If the contractor delays particulars items of tender works or Balance works, it will be got done @ risk & cost from other contractors.

CLAUSE 7C:

Contractor has to furnish Weekly Progress report on works to the Project Manager.

CLAUSE 8

Completion Certificate and Completion Plans

Within ten days of the completion of the work, the contractor shall give notice of such completion to the Project Manager and within thirty days of the receipt of such notice, the Project Manager shall inspect the work and if there is no defect in the work, shall furnish the contractor with a final certificate of completion, otherwise a provisional certificate of physical completion indicating defects (a) to be rectified by the contractor and/or (b) for which payment will be made at reduced rates, shall be issued. But no final certificate of completion shall be issued, nor shall the work be considered to be complete until the contractor shall have removed from the premises on which the work shall be executed all scaffolding, surplus materials, rubbish and all huts and sanitary arrangements required for his/their work people on the site in connection with the execution of the works as shall have been erected or constructed by the contractor(s) and cleaned off the dirt from all wood work, doors, windows, walls, floor or other parts of the building, in, upon, or about which the work is to be executed or of which he may have had possession for the purpose of the execution; thereof, and not until the work shall have been measured by the Project Manager. If the contractor shall fail to comply with the requirements of this Clause as to removal of scaffolding, surplus materials and rubbish and all huts and sanitary arrangements as aforesaid and cleaning off dirt on or before the date fixed for the completion of work, the Project Manager may at the expense of the contractor remove such scaffolding, surplus materials and rubbish etc., and dispose of the same as he thinks fit and clean off such dirt as aforesaid, and the contractor shall have no claim in respect of scaffolding or surplus materials as aforesaid except for any sum actually realized by the sale thereof.

CLAUSE 8A

Contractor to Keep Site Clean

When the annual repairs and maintenance of works are carried out, the splashes and droppings from white washing, color washing, painting etc., on walls, floor, windows, etc shall be removed and the surface cleaned simultaneously with the completion of these items of work in the individual rooms, quarters or premises etc. where the work is done: without waiting for the actual completion of all the other items of work in the contract. In case the contractor fails to comply with the requirements of this clause, the Project Manager shall have the right to get this work done at the cost of the contractor either departmentally or through any other agency. Before taking such action, the Project Manager shall give ten days' notice in writing to the contractor.

CLAUSE 8B

Contractor has to furnish As- built drawings along with the final bills.

Payment of Final Bill

The final bill shall be submitted by the contractor in the same manner as specified in interim bills within three months of physical completion of the work or within one month of the date of the final certificate of completion furnished by the Project Manager whichever is earlier. No further claims shall be made by the contractor after submission of the final bill and these shall be deemed to have been waived and extinguished. Payments of those items of the bill in respect of which there is no dispute and of items in dispute, for quantities and rates as approved by Project Manager, will, as far as possible be made within the period specified herein under, the period being reckoned from the date of receipt of the bill by the Project Manager or his authorized representatives, complete with account of materials issued by the Department and dismantled materials.

(i)	If the Tendered value of work is up to Rs. 45 lac :	2 months
(ii)	If the Tendered value of work is more than Rs.45 lac and up to Rs. 2.5 Crore :	3 months
(iii)	If the Tendered value of work exceeds Rs. 2.5 Crore :	6 months

In case of delay in payment of final bills after prescribed time limit, a simple interest @ 10% per annum shall be paid to the contractor from the date of expiry of prescribed time limit which will be compounded on yearly basis, provided the final bill submitted by the contractor found to be in order.

CLAUSE 9A

Payment of Contractor's Bills to Banks

Payments due to the contractor may, if so desired by him, be made to his bank, registered financial, co-operative or thrift societies or recognized financial institutions instead of direct to him provided that the contractor furnishes to the Project Manager (1) an authorization in the form of a legally valid document such as a power of attorney conferring authority on the bank; registered financial, co-operative or thrift societies or recognized financial institutions to receive payments and (2) his own acceptance of the correctness of the amount made out as being due to him by IIMB or his signature on the bill or other claim preferred against IIMB before settlement by the Project Manager of the account or claim by payment to the bank, registered financial, co-operative or thrift societies or recognized financial institutions. While the receipt given by such banks; registered financial, co-operative or thrift societies or recognized financial institutions shall constitute a full and sufficient discharge for the payment, the contractor shall whenever possible present his bills duly receipted and discharged through his bank, registered financial, co-operative or thrift societies or recognized financial institutions.

Nothing herein contained shall operate to create in favor of the bank; registered financial, co-operative or thrift societies or recognized financial institutions any rights or equities visa- vis the Director IIMB.

CLAUSE 10: (Not Applicable in this contract)

CLAUSE 10A

Materials to be provided by the Contractor

The contractor shall, at his own expense, provide all materials, required for the works other than those which are stipulated to be supplied by the IIMB.

The contractor shall, at his own expense and without delay; supply to the Project Manager samples of materials to be used on the work and shall get these approved in advance. All such materials to be provided by the Contractor shall be in conformity with the specifications laid down or referred to in the contract. The contractor shall, if requested by the Project Manager furnish proof, to the satisfaction of the Project Manager that the materials so comply. The Project Manager shall within thirty days of supply of samples or within such further period as he may require intimate to the Contractor in writing whether samples are approved by him or not. If samples are not approved, the Contractor shall forthwith arrange to supply to the Project Manager for his approval, fresh samples complying with the specifications laid down in the contract. When materials are required to be tested in accordance with specifications, approval of the Project Manager shall be issued after the test results are received.

The Contractor shall at his risk and cost submit the samples of materials to be tested or analyzed and shall not make use of or incorporate in the work any materials represented by the samples until the required tests or analysis have been made and materials finally accepted by the Project Manager. The Contractor shall not be eligible for any claim or compensation either arising out of any delay in the work or due to any corrective measures required to be taken on account of and as a result of testing of materials.

The contractor shall, at his risk and cost, make all arrangements and shall provide all facilities as the Project Manager may require for collecting, and preparing the required number of samples for such tests at such time and to such place or places as may be directed by the Project Manager and bear all charges and cost of testing unless specifically provided for otherwise elsewhere in the contract or specifications. The Project Manager or his authorized representative shall at all times have access to the works and to all workshops and places where work is being prepared or from where materials, manufactured articles or machinery are being obtained for the works and the contractor shall afford every facility and every assistance in obtaining the right to such access.

The Project Manager shall have full powers to require the removal from the premises of all materials which in his opinion are not in accordance with the specifications and in case of default, the Project Manager shall be at liberty to employ at the expense of the contractor, other persons to remove the same without being answerable or accountable for any loss or damage that may happen or arise to such materials. The Project Manager shall also have full powers to require other proper materials to be substituted thereof and in case of default, the Project Manager may cause the same to be supplied and all costs which may attend such removal and substitution shall be borne by the Contractor.

The contractor shall at his own expense, provide a material testing lab at the site for conducting routine field tests. The lab shall be equipped at least with the testing equipment as specified in schedule F.

CLAUSE 10B

Secured Advance on Nonperishable Materials

(i) The contractor, on signing an indenture in the form in Annexure XVIII by the Project Manager, shall be entitled to be paid during the progress of the execution of the work up to 70% of the invoice/purchase value (excluding GST) furnished by contractor Or 60% of the quoted rate (excluding GST) whichever is lowest will be considered for making payment on the advance of any materials which are in the opinion of the Project Manager non-perishable, non-fragile and non-combustible and are in accordance with the contract and which have been brought on the site in connection therewith and are adequately stored and/or protected against damage by weather or other causes but which have not at the time of advance been incorporated in the works. When materials on account of which an advance has been made under this sub-clause are incorporated in the work, the amount of such advance shall be recovered/deducted from the next payment made under any of the clause or clauses of this contract.

Such secured advance shall also be payable on other items of perishable nature, fragile and combustible with the approval of the Project Manager provided the contractor provides a comprehensive insurance cover for the full cost

of such materials. The decision of the Project Manager shall be final and binding on the contractor in this matter. No secured advance, shall however, be paid on high-risk materials such as ordinary glass, sand, petrol, diesel etc.

(ii) Mobilization Advance

Mobilization advance not exceeding 10% of the tendered value may be given, if requested by the contractor in writing within one month of the order to commence the work. Such advance shall be in two or more installments to be determined by the Engineer-in-Charge at his sole discretion. The first installment of such advance shall be released by the Engineer-in-charge to the contractor on a request made by the contractor to the Engineer-in-Charge in this behalf. The second and subsequent installments shall be released by the Engineer-in- Charge only after the contractor furnishes a proof of the satisfactory utilization of the earlier installment to the entire satisfaction of the Engineer-in-Charge.

Before any installment of advance is released, the contractor shall execute a Bank Guarantee Bonds not more than 6 in number from Scheduled Bank for the amount equal to 110% of the amount of advance and valid for the period till recovery of advance. This (Bank Guarantee from Scheduled Bank for the amount equal to 110% of the balance amount of advance) shall be kept renewed from time to time to cover the balance amount and likely period of complete recovery.

Mobilization advance along with Interest will be recovered in Pro data basis in second RAB onwords.

Provided always that provision of Clause 10 B (ii) shall be applicable only when so provided in 'Schedule F'.

CLAUSE 10C ((NOT APPLICABLE IN THIS CONTRACT)

CLAUSE 10CA (NOT APPLICABLE IN THIS CONTRACT)

CLAUSE 10CC (NOT APPLICABLE IN THIS CONTRACT)

CLAUSE 10 D (NOT APPLICABLE IN THIS CONTRACT)

Dismantled Material IIMB Property

The Dismantled IIMB Property should be handed over to Project Manager alog with the detailed Inventory.

CLAUSE 11

Work to be executed in Accordance with Specifications, Drawings, and Orders etc.

The contractor shall execute the whole and every part of the work in the most substantial and workmanlike manner both as regards materials and otherwise in every respect in strict accordance with the specifications. The contractor shall also conform exactly, fully and faithfully to the design, drawings and instructions in writing in respect of the work signed by the Project Manager and the contractor shall be furnished free of charge one copy of the contract documents together with specifications, designs, drawings and instructions.

The contractor shall comply with the provisions of the contract and with the care and diligence execute and maintain the works and provide all labor and materials, tools and plants including for measurements and supervision of all works, structural plans and other things of temporary or permanent nature required for such execution and maintenance in so far as the necessity for providing these, is specified or is reasonably inferred from the contract. The Contractor shall take full responsibility for adequacy, suitability and safety of all the works and methods of construction.

CLAUSE 12

Deviations/ Variations Extent and Pricing

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

The completion cost of any agreement for Maintenance works including works of upgradation, aesthetic, special repair, addition/ alteration shall not exceed 1.25 times of Tendered amount. Any further deviation beyond this limit up to 1.5 times of tendered amount shall be approved by Director with recorded reason and in exceptional case, Chairman CDC shall have full power to approve the deviation beyond 1.50 times of tendered amount with recorded reason and take suitable corrective action.

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

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

ii) 25% of the time calculated in (i) above or such further additional time as may be considered reasonable by the Project Manager.

Deviation, Extra Items and Pricing

12.2.

A. For Project and original works:

In the case of extra item(s) (items that are completely new, and are in addition to the items contained in the contract), the contractor may within fifteen days of receipt of order or occurrence of the item(s) claim rates, supported by proper analysis, which shall include invoices, vouchers etc. and Manufacturer's specification for the work failing which the rate approved later by the Project Manager shall be binding and the Project Manager shall within prescribed time limit of the receipt of the claims supported by analysis, after giving consideration to the analysis of the rates submitted by the contractor, determine the rates on the basis of the market rates and the contractor shall be paid in accordance with the rates so determined, failing which it will be deemed to have been approved.

B. For Maintenance works including works of upgradation, aesthetic, special repair, addition/ alteration:

In the case of Extra Item(s) being the schedule items (Delhi Schedule of Rates items), these shall be paid as per the schedule rate plus cost index (at the time of tender) plus/minus percentage above/ below quoted contract amount.

Payment of Extra items in case of non-schedule items (Non-DSR items) shall be made as per the prevailing market rate.

Deviation, Substituted Items, Pricing

A. For Project and original works:

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

a. If the market rate for the substituted item so determined is more than the market rate of the agreement item (to be substituted), the rate payable to the contractor for the substituted item shall be the rate for the agreement item (to be substituted) so increased to the extent of the difference between the market rates of substituted item and the agreement item (to be substituted).
b. If the market rate for the substituted item so determined is less than the market rate of the agreement item (to be substituted), the rate payable to the contractor for the substituted item shall be the rate for the agreement item (to be substituted) so decreased to the extent of the difference between the market rates of substituted item and the agreement item (to be substituted).
B. For Maintenance works including works of upgradation, aesthetic, special repair, addition/ alteration:

In the case of substitute Item(s) being the schedule items (Delhi Schedule of Rates items), these shall be paid as per the schedule rate plus cost index (at the time of tender) plus/minus percentage above/ below quoted contract amount. Payment of substitute items in case of non-schedule items (Non-DSR items) shall be made as per the prevailing market rate.

Deviation, Deviated Quantities, Pricing

A. For Project and original works:

In the case of contract items, substituted items, contract cum substituted items, which exceed the limits laid down in schedule F, The Quoted rates are valid for the tender qty plus 25 % and over and above that. the contractor may within fifteen days of receipt of order or occurrence of the excess, claim revision of the rates, supported by proper analysis for the work in excess of the above mentioned limits, provided that if the rates so claimed are in excess of the rates specified in the schedule of quantities, the Project Manager shall within prescribed time limit of receipt of the claims supported by analysis, after giving consideration to the analysis of the rates submitted by the contractor, determine the rates on the basis of the market rates and the contractor shall be paid in accordance with the rates so determined.

B. For Maintenance works including works of upgradation, aesthetic, special repair, addition/ alteration:

In the case of contract items, which exceed the limits laid down in schedule F, the contractor shall be paid rates specified in the schedule of quantities.

The prescribed time limits for finalizing rates for Extra Item(s), Substitute Item(s) and Deviated Quantities of contract items is within 30 days after submission of proposal by the contractor without observation of the Project Manager.

12.3. A. For Project and original works:

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

B. For Maintenance works including works of upgradation, aesthetic, special repair, addition/ alteration:

In case of decrease in the rates prevailing in the market of items for the work in excess of the limits laid down in Schedule F, the Project Manager shall after giving notice to the contractor within one month of occurrence of the excess and after taking into consideration any reply received from him within fifteen days of the receipt of the notice, revise the rates for the work in question within one month of the expiry of the said period of fifteen days having regard to the market rates.

12.4. The contractor shall send to the Project Manager once every three months, an up to date account giving complete details of all claims for additional payments to which the contractor may consider himself entitled and of all additional work ordered by the Project Manager which he has executed during the preceding quarter failing which the contractor shall be deemed to have waived his right. However, the Director, IIMB may authorize consideration of such claims on merits.

12.5. For the purpose of operation of Schedule “F”, the following works shall be treated as works relating to foundation unless & otherwise defined in the contract:

(i) For Buildings: All works up to 1.2 meters above ground level or up to floor 1 level whichever is lower.

(ii) For abutments, piers and well staining: All works up to 1.2 m above the bed level.

(iii) For retaining walls, wing walls, compound walls, chimneys, overhead reservoirs/ tanks and other elevated structures: All works up to 1.2 meters above the ground level.

(iv) For reservoirs/tanks (other than overhead reservoirs/tanks): All works up to 1.2 meters above the ground level.

(v) For basement: All works up to 1.2 m above ground level or up to floor 1 level whichever is lower.

(vi) For Roads, all items of excavation and filling including treatment of sub base

12.6. Any operation incidental to or necessarily has to be in contemplation of tenderer while filing. tender, or necessary for proper execution of the item included in the Schedule of quantities or in the schedule of rates mentioned above, whether or not, specifically indicated in the description of the item and the relevant specifications, shall be deemed to be included in the rates quoted by the tenderer or the rate given in the said schedule of rates, as the case may be. Nothing extra shall be admissible for such operations.

CLAUSE 13

Foreclosure of contract due to Abandonment or Reduction in Scope of Work

If at any time after acceptance of the tender or during the progress of work, the purpose or object for which the work is being done changes due to any supervening cause and as a result of which the work has to be abandoned or reduced in scope the Project Manager shall give notice in writing to that effect to the contractor stating the decision as well as the cause for such decision and the contractor shall act accordingly in the matter. The contractor shall have no claim to any payment of compensation or otherwise whatsoever, on account of any profit or advantage which he might have derived from the execution of the works in full but which he did not derive in consequence of the foreclosure of the whole or part of the works.

The contractor shall be paid at contract rates, full amount for works executed at site and, in addition, a reasonable amount as certified by the Project Manager for the items hereunder mentioned which could not be utilized on the work to the full extent in view of the foreclosure;

(i) Any expenditure incurred on preliminary site work, e.g. temporary access roads, temporary labor huts, staff quarters and site office; storage accommodation and water storage tanks.

(ii) IIMB shall have the option to take over contractor’s materials or any part thereof either brought to site or of which the contractor is legally bound to accept delivery from suppliers (for incorporation in or incidental to the work) provided, however IIMB shall be bound to take over the materials or such portions thereof as the contractor does not desire to retain. For materials taken over or to be taken over by IIMB, cost of such materials as detailed by Project Manager shall be paid. The cost shall, however, take into account purchase price, cost of transportation and deterioration or damage which may have been caused to materials whilst in the custody of the contractor.

(iii) If any materials supplied by IIMB are rendered surplus, the same except normal wastage shall be returned by the contractor to IIMB at rates not exceeding those at which these were originally issued, less allowance for any deterioration or damage which may have been caused whilst the materials were in the custody of the contractor. In addition, cost of transporting such materials from site to IIMB stores, if so required by IIMB, shall be paid.

(iv) Reasonable compensation for transfer of T & P from site to contractor’s permanent stores or to his other works, whichever is less. If T & P are not transported to either of the said places, no cost of transportation shall be payable.

(v) Reasonable compensation for repatriation of contractor’s site staff and imported labor to the extent necessary.

The contractor shall, if required by the Project Manager, furnish to him, books of account, wage books, time sheets and other relevant documents and evidence as may be necessary to enable him to certify the reasonable amount payable under this condition.

The reasonable amount of items on (i), (iv) and (v) above shall not be in excess of 2% of the cost of the work remaining incomplete on the date of closure, i.e. total stipulated cost of the work as per accepted tender less the cost of work actually executed under the contract and less the cost of contractor's materials at site taken over by the IIMB as per item (ii) above. Provided always that against any payments due to the contractor on this account or otherwise, the Project Manager shall be entitled to recover or be credited with any outstanding balances due from the contractor for advance paid in respect of any tool, plants and materials and any other sums which at the date of termination were recoverable by the IIMB from the contractor under the terms of the contract.

In the event of action being taken under Clause 13 to reduce the scope of work, the contractor may furnish fresh Performance Guarantee on the same conditions, in the same manner and at the same rate for the balance tendered amount and initially valid up to the extended date of completion or stipulated date of completion if no extension has been granted plus 60 days beyond that. Wherever such a fresh Performance Guarantee is furnished by the contractor the Project Manager may return the previous Performance Guarantee.

Clause 14

Carrying out part work at risk & cost of contractor

If contractor:

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

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

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

The Project Manager without invoking action under clause 3 may, without prejudice to any other right or remedy against the contractor which have either accrued or accrue thereafter to IIMB, by a notice in writing to take the part work / part incomplete work of any item(s) out of his hands and shall have powers to:

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

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

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

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

Any excess expenditure incurred or to be incurred by IIMB in completing the part work/ part incomplete work of any item(s) or the excess loss of damages suffered or may be suffered by IIMB as aforesaid after allowing such credit

shall without prejudice to any other right or remedy available to IIMB in law or per as agreement be recovered from any money due to the contractor on any account, and if such money is insufficient, the contractor shall be called upon in writing and shall be liable to pay the same within 30 days.

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

In the event of above course being adopted by the Project Manager, the contractor shall have no claim to compensation for any loss sustained by him by reason of his having purchased or procured any materials or entered into any engagements or made any advance on any account or with a view to the execution of the work or the performance of the contract.

CLAUSE 15

Suspension of Work

(i) The contractor shall, on receipt of the order in writing of the Project Manager, (whose decision shall be final and binding on the contractor) suspend the progress of the works or any part thereof for such time and in such manner as the Project Manager may consider necessary so as not to cause any damage or injury to the work already done or endanger the safety thereof for any of the following reasons:

a. on account of any default on the part of the contractor or;
b. for proper execution of the works or part thereof for reasons other than the default of the contractor; or
c. For safety of the works or part thereof.

The contractor shall, during such suspension, properly protect and secure the works to the extent necessary and carry out the instructions given in that behalf by the Project Manager.

(ii) If the suspension is ordered for reasons (b) and (c) in sub-para (i) above:

a. The contractor shall be entitled to an extension of time equal to the period of every such suspension PLUS 25%, for completion of the item or group of items of work for which a separate period of completion is specified in the contract and of which the suspended work forms a part, and;

b. If the total period of all such suspensions in respect of an item or group of items or work for which a separate period of completion is specified in the contract exceeds thirty days, the contractor shall, in addition, be entitled to such compensation as the Project Manager may consider reasonable in respect of salaries and/or wages paid by the contractor to his employees and labor at site, remaining idle during the period of suspension, adding thereto 2% to cover indirect expenses of the contractor provided the contractor submits his claim supported by details to the Project Manager within fifteen days of the expiry of the period of 30 days.

(iii) If the works or part thereof is suspended on the orders of the Project Manager for more than three months at a time, except when suspension is ordered for reason (a) in sub- para (i) above, the contractor may after receipt of such order serve a written notice on the Project Manager requiring permission within fifteen days from receipt by the Project Manager of the said notice, to proceed with the work or part thereof in regard to which progress has been suspended and if such permission is not granted within that time, the contractor, if he intends to treat the suspension, where it affects only a part of the works as an omission of such part by IIMB or where it affects whole of the works, as an abandonment of the works by IIMB, shall within ten days of expiry of such period of 15 days give notice in writing of his intention to the Project Manager. In the event of the contractor treating the suspension as an abandonment of the contract by IIMB, he shall have no claim to payment of any compensation on account of any profit or advantage which he might have derived from the execution of the work in full but which he could not derive in consequence of the abandonment. He shall, however, be entitled to such compensation, as the Project Manager may consider reasonable, in respect of salaries and/or wages paid by him to his employees and labor at site, remaining idle in consequence adding to the total thereof 2% to cover indirect expenses of the contractor provided the contractor submits his claim supported by details to the Project Manager within 30 days of the expiry of the period of 3 months.

CLAUSE 15 A: (Not Applicable in the Contract)

CLAUSE 16

Action in case Work not done as per Specifications

All works under or in course of execution or executed in pursuance of the contract, shall at all times be open and accessible to the inspection and supervision of the Project Manager, his authorized subordinates in charge of the work and the Project team. Orders given to the Contractor's agent shall be considered to have the same force as if they had been given to the contractor himself.

If it shall appear to the Project Manager or his authorized subordinates in charge of the work and Quality Assurance or his subordinate Project Managers or the Project Managers of the organization engaged by the Department for Quality Assurance, that any work has been executed with unsound, imperfect, or unskillful workmanship, or with materials or articles provided by him for the execution of the work which are unsound or of a quality inferior to that contracted or otherwise not in accordance with the contract, the contractor shall, on demand in writing which shall be made within twelve months (six months in the case of work costing Rs. 10 Lac and below except road work) of the completion of the work from the Project Manager specifying the work, materials or articles complained of notwithstanding that the same may have been passed, certified and paid for forthwith rectify, or remove and reconstruct the work so specified in whole or in part, as the case may require or as the case may be, remove the materials or articles so specified and provide other proper and suitable materials or articles at his own charge and cost. In the event of the failing to do so within a period specified by the Project Manager in his demand aforesaid, then the contractor shall be liable to pay compensation at the same rate as under clause 2 of the contract (for non-completion of the work in time) for this default.

In such case the Project Manager may not accept the item of work at the rates applicable under the contract but may accept such items at reduced rates as the authority specified in schedule 'F' may consider reasonable during the preparation of on account bills or final bill if the item is so acceptable without detriment to the safety and utility of the item and the structure or he may reject the work outright without any payment and/or get it and other connected and incidental items rectified, or removed and re-executed at the risk and cost of the contractor. Decision of the Project Manager to be conveyed in writing in respect of the same will be final and binding on the contractor.

CLAUSE 17

Contractor Liable for Damages, defects during defect liability period

If the contractor or his working people or servants shall break, deface, injure or destroy any part of building in which they may be working, or any building, road, road kerb, fence, enclosure, water pipe, cables, drains, electric or telephone post or wires, trees, grass or grassland, or cultivated ground contiguous to the premises on which the work or any part is being executed, or if any damage shall happen to the work while in progress, from any cause whatever or if any defect, shrinkage or other faults appear in the work within twelve months (six months in the case of work costing Rs. Ten lacs and below except road work) after a certificate final or otherwise of its completion shall have been given by the Project Manager as aforesaid arising out of defect or improper materials or workmanship the contractor shall upon receipt of a notice in writing on that behalf make the same good at his own expense or in default the Project Manager cause the same to be made good by other workmen and deduct the expense from any sums that may be due or at any time thereafter may become due to the contractor, or from his security deposit or the proceeds of sale thereof or of a sufficient portion thereof. The security deposit of the contractor shall not be refunded before the expiry of twelve months (six months in the case of work costing Rs. Ten lakhs and below except road work) after the issue of the certificate final or otherwise, of completion of work, or till the final bill has been prepared and passed whichever is later. Provided that in the case of road work, if in the opinion of the Project Manager, half of the security deposit is sufficient, to meet all liabilities of the contractor under this contract, half of the security deposit will be refundable after six months and the remaining half after twelve months of the issue of the said certificate of completion or till the final bill has been prepared and passed whichever is later.

In case of Maintenance and Operation works of E&M services, the security deposit deducted from contractors shall be refunded within one month from the date of final payment or within one month from the date of completion of the maintenance contract whichever is earlier.

CLAUSE 18

Contractor to Supply Tools & Plants etc.

The contractor shall provide at his own cost all materials (except such special materials, if any, as may in accordance with the contract be supplied from the Project Manager's stores), machinery, tools & plants as specified in schedule F. In addition to this, appliances, implements, other plants, ladders, cordage, tackle, scaffolding and temporary works required for the proper execution of the work, whether original, altered or substituted and whether included in the specifications or other documents forming part of the contract or referred to in these conditions or not, or which may be necessary for the purpose of satisfying or complying with the requirements of the Project Manager as to any matter as to which under these conditions he is entitled to be satisfied, or which he is entitled to require together with carriage therefore to and from the work. The contractor shall also supply without charge the requisite number of persons with the means and materials, necessary for the purpose of setting out works, and counting, weighing and assisting the measurement for examination at any time and from time to time of the work or materials. Failing his so doing, the same may be provided by the Project Manager at the expense of the contractor and the expenses may be deducted, from any money due to the contractor, under this contract or otherwise and/or from his security deposit or the proceeds of sale thereof, or of a sufficient portions thereof.

CLAUSE 18 A

Recovery of Compensation paid to Workmen

In every case in which by virtue of the provisions sub-section (1) of Section 12, of the Workmen's Compensation Act, 1923, IIMB is obliged to pay compensation to a workman employed by the contractor, in execution of the works, IIMB will recover from the contractor, the amount of the compensation so paid; and, without prejudice to the rights of the IIMB under sub-section (2) of Section 12, of the said Act, IIMB shall be at liberty to recover such amount or any part thereof by deducting it from the security deposit or from any sum due by IIMB to the contractor whether under this contract or otherwise. IIMB shall not be bound to contest any claim made against it under sub-section (1) of Section 12, of the said Act, except on the written request of the contractor and upon his giving to IIMB full security for all costs for which IIMB might become liable in consequence of contesting such claim.

CLAUSE 18 B

Ensuring Payment and Amenities to Workers if Contractor fails

ln every case in which by virtue of the provisions of the Contract Labor (Regulation and Abolition) Act, 1970, and of the Contract Labor (Regulation and Abolition) Central Rules, 1971, IIMB is obliged to pay any amounts of wages to a workman employed by the contractor in execution of the works, or to incur any expenditure in providing welfare and health amenities required to be provided under the above said Act and the rules under Clause 19H or under the C.P.W.D. Contractor's Labor Regulations from time to time for the protection of health and sanitary arrangements for workers employed by Contractors, IIMB will recover from the contractor, the amount of wages so paid or the amount of expenditure so incurred; and without prejudice to the rights of the IIMB under sub-section(2) of Section 20, and sub-section (4) of Section 21, of the Contract Labor (Regulation and Abolition) Act, 1970, IIMB shall be at liberty to recover such amount or any part thereof by deducting it from the security deposit or from any sum due by IIMB to the contractor whether under this contract or otherwise IIMB shall not be bound to contest any claim made against it under sub-section (1) of Section 20, sub-section (4) of Section 21, of the said Act, except on the written request of the contractor and upon his giving to the IIMB full security for all costs for which IIMB might become liable in contesting such claim.

CLAUSE 19

Labor Laws to be complied by the Contractor

The contractor shall obtain a valid license under the Contract Labor (R&A) Act, 1970, and the Contract Labor (Regulation and Abolition) Central Rules, 1971, before the commencement of the work, and continue to have a valid license until the completion of the work. **The contractor shall also comply with provisions of the Inter-State Migrant Workmen (Regulation of Employment and Conditions of Service) Act, 1979.**

The contractor shall also abide by the provisions of the Child Labor (Prohibition and Regulation) Act, 1986.

The contractor shall also comply with the provisions of the building and other Construction Workers (Regulation of Employment & Conditions of Service) Act, 1996 and the building and other Construction Workers Welfare Cess Act, 1996.

Any failure to fulfil these requirements shall attract the penal provisions of this contract arising out of the resultant non-execution of the work

CLAUSE 19A

No labor below the age of fourteen years shall be employed on the work.

CLAUSE 19 B

Payment of Wages

(i) The contractor shall pay to labor employed by him either directly or through subcontractors, wages not less than fair wages as defined in the C.P.W.D. Contractor's Labor Regulations or as per the provisions of the Contract Labor (Regulation and Abolition) Act, 1970 and the contract Labor (Regulation and Abolition) Central Rules, 1971, wherever applicable.

(ii) The contractor shall, notwithstanding the provisions of any contract to the contrary, cause to be paid fair wage to labor indirectly engaged on the work, including any labor engaged by his sub-contractors in connection with the said work, as if the labor had been immediately employed by him.

(iii) In respect of all labor directly or indirectly employed in the works for performance of the contractor's part of this contract, the contractor shall comply with or cause to be complied with the Central Public Works Department contractor's Labor Regulations made by IIMB from time to time in regard to payment of wages, wage period, deductions from wages recovery of wages not paid and deductions unauthorizedly made, maintenance of wage books or wage slips, publication of scale of wages and other terms of employment, inspection and submission of periodical returns and all other matters of the like nature or as per the provisions of the Contract Labor (Regulation and Abolition) Act, 1970, and the Contract Labor (Regulation and Abolition) Central Rules, 1971, wherever applicable.

(iv)

a. The Project Manager concerned shall have the right to deduct from the moneys due to the contractor any sum required or estimated to be required for making good the loss suffered by a worker or workers by reason of non-fulfilment of the conditions of the contract for the benefit of the workers, non-payment of wages or of deductions made from his or their wages which are not justified by their terms of the contract or non-observance of the Regulations.

b. Under the provision of Minimum Wages (Central) Rules, 1950, the contractor is bound to allow to the labors directly or indirectly employed in the works one day rest for 6 days continuous work and pay wages at the same rate as for duty. In the event of default, the Project Manager shall have the right to deduct the sum or sums not paid on account of wages for weekly holidays to any labors and pay the same to the persons entitled thereto from any money due to the contractor by the Project Manager concerned.

(v) The contractor shall comply with the provisions of the Payment of Wages Act, 1936, Minimum Wages Act, 1948, Employees Liability Act, 1938, Workmen's Compensation Act, 1923, Industrial Disputes Act, 1947, Maternity Benefits Act, 1961, and the Contractor's Labor (Regulation and Abolition) Act 1970, or the modifications thereof or any other laws relating thereto and the rules made thereunder from time to time.

(vi) The contractor shall indemnify and keep indemnified IIMB against payments to be made under and for the observance of the laws aforesaid and the C.P.W.D. Contractor's Labor Regulations without prejudice to his right to claim indemnity from his sub-contractors.

(vii) The laws aforesaid shall be deemed to be a part of this contract and any breach thereof shall be deemed to be a breach of this contract.

(viii) Whatever is the minimum wage for the time being, or if the wage payable is higher than such wage, such wage shall be paid by the contractor to the workmen directly without the intervention of Jamadar and that Jamadar shall not be entitled to deduct or recover any amount from the minimum wage payable to the workmen as and by way of commission or otherwise.

(ix) The contractor shall ensure that no amount by way of commission or otherwise is deducted or recovered by the Jamadar from the wage of workmen

CLAUSE 19C

In respect of all labor directly or indirectly employed in the work for the performance of the contractor's part of this contract, the contractor shall at his own expense arrange for the safety provisions as per C.P.W.D. Safety Code framed from time to time and shall at his own expense provide for all facilities in connection therewith. In case the contractor fails to make arrangement and provide necessary facilities as aforesaid, he shall be liable to pay a penalty of Rs.200/- for each default and in addition, the Project Manager shall be at liberty to make arrangement and provide facilities as aforesaid and recover the costs incurred in that behalf from the contractor.

CLAUSE 19 D

The contractor shall submit by the 4th and 19th of every month, to the Project Manager, a true statement showing in respect of the second half of the preceding month and the first half of the current month respectively:-

1) the number of laborers employed by him on the work,

2) their working hours,

3) the wages paid to them,

4) the accidents that occurred during the said fortnight showing the circumstances under which they happened and the extent of damage and injury caused by them, and

5) The number of female workers who have been allowed maternity benefit according to Clause 19F and the amount paid to them.

Failing which the contractor shall be liable to pay to IIMB, a sum not exceeding Rs.200/- for each default or materially incorrect statement. The decision of the PMC Project Manager shall be final in deducting from any bill due to the contractor; the amount levied as fine and be binding on the contractor.

CLAUSE 19 E

In respect of all labors directly or indirectly employed in the works for the performance of the contractor's part of this contract, the contractor shall comply with or cause to be complied with all the rules framed by IIMB from time to time for the protection of health and sanitary arrangements for workers employed by the IIMB and its contractors.

CLAUSE 19 F

Leave and pay during leave shall be regulated as follows:-

1) Leave :

i) in the case of delivery - maternity leave not exceeding 8 weeks, 4 weeks up to and including the day of delivery and 4 weeks following that day,

ii) in the case of miscarriage - up to 3 weeks from the date of miscarriage.

2) Pay :

i) in the case of delivery - leave pay during maternity leave will be at the rate of the women's average daily earnings, calculated on total wages earned on the days when full time work was done during a period of three months immediately preceding the date on which she gives notice that she expects to be confined or at the rate of Rupee one only a day whichever is greater.

ii) in the case of miscarriage - leave pay at the rate of average daily earning calculated on the total wages earned on the days when full time work was done during a period of three months immediately preceding the date of such miscarriage.

3) Conditions for the grant of Maternity Leave:

No maternity leave benefit shall be admissible to a woman unless she has been employed for a total period of not less than six months immediately preceding the date on which she proceeds on leave.

4) The contractor shall maintain a register of Maternity (Benefit) in the Prescribed Form as shown in appendix -I and II, and the same shall be kept at the place of work.

CLAUSE 19 G

In the event of the contractor(s) committing a default or breach of any of the provisions of the Central Public Works Department, Contractor's Labor Regulations and Model Rules for the protection of health and sanitary arrangements for the workers as amended from time to time or furnishing any information or submitting or filing any statement under the provisions of the above Regulations and' Rules which is materially incorrect, he/they shall, without prejudice to any other liability, pay to the IIMB a sum not exceeding Rs.200/- for every default, breach or furnishing, making, submitting, filing such materially incorrect statements and in the event of the contractor(s) defaulting continuously in this respect, the penalty may be enhanced to Rs.200/- per day for each day of default subject to a maximum of 5 per cent of the estimated cost of the work put to tender. The decision of the Project Manager shall be final and binding on the parties.

Should it appear to the Project Manager that the contractor(s) is/are not properly observing and complying with the provisions of the C.P.W.D. Contractor's Labor Regulations and Model Rules and the provisions of the Contract Labor (Regulation and Abolition) Act 1970, and the Contract Labor (R& A) Central Rules 1971, for the protection of health and sanitary arrangements for work-people employed by the contractor(s) (hereinafter referred as "the said Rules") the Project Manager shall have power to give notice in writing to the contractor(s) requiring that the said Rules be complied with and the amenities prescribed therein be provided to the work-people within a reasonable time to be specified in the notice. If the contractor(s) shall fail within the period specified in the notice to comply with and/observe the said Rules and to provide the amenities to the work-people as aforesaid, the Project Manager shall have the power to provide the amenities hereinbefore mentioned at the cost of the contractor(s). The contractor(s) shall erect, make and maintain at his/their own expense and to approved standards all necessary huts and sanitary arrangements required for his/their work-people on the site in connection with the execution of the works, and if the same shall not have been erected or constructed, according to approved standards, the Project Manager shall have power to give notice in writing to the contractor(s) requiring that the said huts and sanitary arrangements be remodeled and/or reconstructed according to approved standards, and if the contractor(s) shall fail to remodel or reconstruct such huts and sanitary arrangements according to approved standards within the period specified in the notice, the Project Manager shall have the power to remodel or reconstruct such huts and sanitary arrangements according to approved standards at the cost of the contractor(s).

CLAUSE 19 H

The contractor(s) shall at his/their own cost provide his/their labor with a sufficient number of huts (hereinafter referred to as the camp) of the following specifications on a suitable plot of land to be approved by the Project Manager.

(i)

a. The minimum height of each hut at the eaves level shall be 2.10m (7 ft.) and the floor area to be provided will be at the rate of 2.7 sq.m. (30 sq.ft.) For each member of the worker's family staying with the laborer.

b. The contractor(s) shall in addition construct suitable cooking places having a minimum area of 1.80m x 1.50m (6'x5') adjacent to the hut for each family.

c. The contractor(s) shall also construct temporary latrines and urinals for the use of the laborers each on the scale of not less than four per each one hundred of the total strength, separate latrines and urinals being provided for women.

d. The contractor(s) shall construct sufficient number of bathing and washing places, one unit for every 25 persons residing in the camp. These bathing and washing places shall be suitably screened.

(ii)

a. All the huts shall have walls of sun-dried or burnt-bricks laid in mud mortar or other suitable local materials as may be approved by the Project Manager. In case of sun-dried bricks, the walls should be plastered with mud gobri on both sides. The floor may be kutcha but plastered with mud gobri and shall be at least 15 cm (6") above the

surrounding ground. The roofs shall be laid with thatch or any other materials as may be approved by the Project Manager and the contractor shall ensure that throughout the period of their occupation, the roofs remain water-tight.

b. The contractor(s) shall provide each hut with proper ventilation.

c. All doors, windows, and ventilators shall be provided with suitable leaves for security purposes.

d. There shall be kept an open space of at least 7.2m (8 yards) between the rows of huts which may be reduced to 6m (20 ft.) according to the availability of site with the approval of the Project Manager. Back to back construction will be allowed.

(iii) **Water Supply** - The contractor(s) shall provide adequate supply of water for the use of laborers. The provisions shall not be less than two gallons of pure and wholesome water per head per day for drinking purposes and three gallons of clean water per head per day for bathing and washing purposes. Where piped water supply is available, supply shall be at stand posts and where the supply is from wells or river, tanks which may be of metal or masonry, shall be provided. The contractor(s) shall also at his/ their own cost make arrangements for laying pipe lines for water supply to his/ their labor camp from the existing mains wherever available, and shall pay all fees and charges therefore.

(iv) The site selected for the camp shall be high ground, removed from jungle.

(v) **Disposal of Excreta** - The contractor(s) shall make necessary arrangements for the disposal of excreta from the latrines by trenching or incineration which shall be according to the requirements laid down by the Local Health Authorities. If trenching or incineration is not allowed, the contractor(s) shall make arrangements for the removal of the excreta through the Municipal Committee/authority and inform it about the number of laborers employed so that arrangements may be made by such Committee/authority for the removal of the excreta. All charges on this account shall be borne by the contractor and paid direct by him to the Municipality/authority. The contractor shall provide one sweeper for every eight seats in case of dry system.

(vi) **Drainage** - The contractor(s) shall provide efficient arrangements for draining away sullage water so as to keep the camp neat and tidy.

(vii) The contractor(s) shall make necessary arrangements for keeping the camp area sufficiently lighted to avoid accidents to the workers.

(viii) **Sanitation** - The contractor(s) shall make arrangements for conservancy and sanitation in the labor camps according to the rules of the Local Public Health and Medical Authorities.

CLAUSE 19 I

The Project Manager may require the contractor to dismiss or remove from the site of the work any person or persons in the contractors' employ upon the work who may be incompetent or misconduct himself and the contractor shall forthwith comply with such requirements. In respect of maintenance/repair or renovation works etc. where the labor have an easy access to the individual houses, the contractor shall issue identity cards to the laborers, whether temporary or permanent and he shall be responsible for any untoward action on the part of such labor. Project Manager will display a list of contractors working in the colony/Blocks on the notice board in the colony and also at the service center, to apprise the residents about the same.

CLAUSE 19J

It shall be the responsibility of the contractor to see that the building under construction is not occupied by anybody unauthorizedly during construction, and is handed over to the Project Manager with vacant possession of complete building. If such building though completed is occupied illegally, then the Project Manager shall have the option to refuse to accept the said building/buildings in that position. Any delay in acceptance on this account will be treated as the delay in completion and for such delay, a levy up to 5% of tendered value of work may be imposed by the Director, IIMB whose decision shall be final both with regard to the justification and quantum and be binding on the contractor.

However, the Director, IIMB, through a notice, may require the contractor to remove the illegal occupation any time on or before construction and delivery.

CLAUSE 19K

Employment of skilled/semi-skilled workers

The contractor shall, at all stages of work, deploy skilled/semi-skilled tradesmen who are qualified and possess certificate in particular trade from CPWD Training Institute/Industrial Training Institute/National Institute of construction Management and Research (NICMAR)/ National Academy of Construction, CIDC or any similar reputed and recognized Institute managed/ certified by State/Central IIMB. The number of such qualified tradesmen shall not be less than 20% of total skilled/semi-skilled workers required in each trade at any stage of work. The contractor shall submit number of man days required in respect of each trade, its scheduling and the list of qualified tradesmen along with requisite certificate from recognized Institute to Project Manager for approval. Notwithstanding such approval, if the tradesmen are found to have inadequate skill to execute the work of respective trade, the contractor shall substitute such tradesmen within two days of written notice from Project Manager. Failure on the part of contractor to obtain approval of Project Manager or failure to deploy qualified tradesmen will attract a compensation to be paid by contractor at the rate of Rs. 100 per such tradesman per day. Decision of Project Manager as to whether particular tradesman possesses requisite skill and amount of compensation in case of default shall be final and binding.

Provided always, that the provisions of this clause, shall not be applicable for works with estimated cost put to tender being less than Rs. 5 crores.

CLAUSE 19L

Contribution of EPF and ESI

The ESI and EPF contributions on the part of employer in respect of this contract shall be paid by the contractor.

CLAUSE 20

Minimum Wages Act to be complied with

The contractor shall comply with all the provisions of the Minimum Wages Act, 1948, and Contract Labor (Regulation and Abolition) Act, 1970, amended from time to time and rules framed thereunder and other labor laws affecting contract labor that may be brought into force from time to time.

CLAUSE 21

Work not to be sublet.

The contract shall not be assigned or sublet without the written approval of the Project Manager And if the contractor shall assign or sublet his contract, or attempt to do so, or become insolvent or commence any insolvency proceedings or make any composition with his creditors or attempt to do so, or if any bribe, gratuity, gift, loan, perquisite, reward or advantage pecuniary or otherwise, shall either directly or indirectly, be given, promised or offered by the contractor, or any of his servants or agent to any public Project Manager or person in the employ of IIMB in any way relating to his office or employment, or if any such Project Manager or person shall become in any way directly or indirectly interested in the contract, the Project Manager on behalf of the Director IIMB shall have power to adopt the course specified in Clause 3 hereof in the interest of IIMB and in the event of such course being adopted, the consequences specified in the said Clause 3 shall ensue.

CLAUSE 22

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

CLAUSE 23

Changes in firm's Constitution to be intimated

Where the contractor is a partnership firm, the previous approval in writing of the Project Manager shall be obtained before any change is made in the constitution of the firm. Where the contractor is an individual or a Hindu undivided family business concern, such approval as aforesaid shall likewise be obtained before the contractor enters into any partnership agreement where under the partnership firm would have the right to carry out the works hereby

undertaken by the contractor. If previous approval as aforesaid is not obtained, the contract shall be deemed to have been assigned in contravention of Clause 21 hereof and the same action may be taken, and the same consequences shall ensue as provided in the said Clause 21.

CLAUSE 24

All works to be executed under the contract shall be executed under the direction and subject to the approval in all respects of the Project Manager who shall be entitled to direct at what point or points and in what manner they are to be commenced, and from time to time carried on.

CLAUSE 25

Settlement of Disputes & Arbitration

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

(i) If the contractor considers any work demanded of him to be outside the requirements of the contract, or disputes any drawings, record or decision given in writing by the Project Manager considers any act or decision of the contractor on any matter in connection with or arising out of the contract or carrying out of the work, to be unacceptable and is disputed, such party shall promptly within 15 days of the arising of the disputes request the Director IIMB who shall refer the dispute to the Dispute Redressal Committee (DRC) within 15 days along with a list of disputes with amounts claimed if any in respect of each such dispute. The Dispute Redressal Committee (DRC) shall give the opposing party two weeks for a written response, and, give its decision within a period of 30 days extendable by 10 days by consent of both the parties from the receipt of reference from Director. The constitution of Dispute Redressal Committee (DRC) shall be as indicated in Schedule 'F'. Provided that no party shall be represented before the Dispute Redressal Committee by an advocate/legal counsel etc

If the Dispute Redressal Committee (DRC) fails to give its decision within the aforesaid period or any party is dissatisfied with the decision of Dispute Redressal Committee (DRC) or expiry of time limit given above, then either party may within a period of 30 days from the receipt of the decision of Dispute Redressal Committee (DRC), give notice to the Director, IMB, in charge of the work for appointment of arbitrator on prescribed proforma as per Appendix XV under intimation to the other party.

It is a term of contract that each party invoking arbitration must exhaust the aforesaid mechanism of settlement of claims/disputes prior to invoking arbitration.

The Director IIMB shall in such case appoint the sole arbitrator or one of the three arbitrators as the case may be within 30 days of receipt of such a request and refer such disputes to arbitration. Wherever the Arbitral Tribunal consists of three Arbitrators, the contractor shall appoint one arbitrator within 30 days of making request for arbitration or of receipt of request by Project Manager to Director for appointment of arbitrator, as the case may be, and two appointed arbitrators shall appoint the third arbitrator who shall act as the Presiding Arbitrator. In the event of

A.) A party fails to appoint the second Arbitrator, or

B.) The two appointed Arbitrators fail to appoint the Presiding Arbitrator, then

The Director IIMB shall appoint the second or Presiding Arbitrator as the case may be.

(ii) Disputes or difference shall be referred for adjudication through arbitration by a Tribunal having sole arbitrator where Tendered amount is Rs. 100 Crore or less. Where Tendered Value is more than Rs. 100 Crore, Tribunal shall consist of three Arbitrators as above. The requirements of the Arbitration and Conciliation Act, 1996 (26 of 1996) and any further statutory modifications or re-enactment thereof and the rules made there under and for the time being in force shall be applicable.

It is a term of this contract that the party invoking arbitration shall give a list of disputes with amounts claimed, if any, in respect of each such dispute along with the notice for appointment of arbitrator and giving reference to the decision of the DRC.

It is also a term of this contract that any member of the Arbitration Tribunal shall be a Graduate Engineer with experience in handling public works engineering contracts at a level not lower than Director (Joint Secretary level of IIMB of India). This shall be treated as a mandatory qualification to be appointed as arbitrator.

Parties, before or at the time of appointment of Arbitral Tribunal may agree in writing for fast track arbitration as per the Arbitration and Conciliation Act, 1996 (26 of 1996) as amended in 2015.

Subject to provision in the Arbitration and Conciliation Act, 1996 (26 of 1996) as amended in 2015 whereby the counter claims if any can be directly filed before the arbitrator without any requirement of reference by the appointing authority, the arbitrator shall adjudicate on only such disputes as are referred to him by the appointing authority and give separate award against each dispute and claim referred to him and in all cases where the total amount of the claims by any party exceeds Rs. 1,00,000/-, the arbitrator shall give reasons for the award.

It is also a term of the contract that if any fees are payable to the arbitrator, these shall be paid as per the Act.

The place of arbitration shall be as mentioned in Schedule F. In case there is no mention of place of arbitration, the arbitral tribunal shall determine the place of arbitration.

The venue of the arbitration shall be such place as may be fixed by the Arbitral Tribunal in consultation with both the parties. Failing any such agreement, then the Arbitral Tribunal shall decide the venue.

CLAUSE 26

Contractor to indemnify IIMB against Patent Rights

The contractor shall fully indemnify and keep indemnified the Director IIMB against any action, claim or proceeding relating to infringement or use of any patent or design or any alleged patent or design rights and shall pay any royalties which may be payable in respect of any article or part thereof included in the contract. In the event of any claims made under or action brought against IIMB in respect of any such matters as aforesaid, the contractor shall be immediately notified thereof and the contractor shall be at liberty, at his own expense, to settle any dispute or to conduct any litigation that may arise therefrom, provided that the contractor shall not be liable to indemnify the Director IIMB if the infringement of the patent or design or any alleged patent or design right is the direct result of an order passed by the Project Manager in this behalf.

CLAUSE 27: (Not Applicable in the Contract)

CLAUSE 28

Action where no Specifications are specified

In the case of any class of work for which there is no such specifications as referred to in Clause 11, such work shall be carried out in accordance with the Bureau of Indian Standards Specifications. In case, there are no such specifications in Bureau of Indian Standards, the work shall be carried out as per manufacturers' specifications, if not available then as per District Specifications. In case there are no such specifications as required above, the work shall be carried out in all respects in accordance with the instructions and requirements of the Project Manager.

CLAUSE 29

Withholding and lien in respect of sum due from contractor

(i) Whenever any claim or claims for payment of a sum of money arises out of or under the contract or against the contractor, the Project Manager or the IIMB shall be entitled to withhold and also have a lien to retain such sum or sums in whole or in part from the security, if any deposited by the contractor and for the purpose aforesaid, the Project Manager or the IIMB shall be entitled to withhold the security deposit, if any, furnished as the case may be and also have a lien over the same pending finalization or adjudication of any such claim. In the event of the security being insufficient to cover the claimed amount or amounts or if no security has been taken from the contractor, the Project Manager or the IIMB shall be entitled to withhold and have a lien to retain to the extent of such claimed amount or amounts referred to above, from any sum or sums found payable or which may at any time thereafter

become payable to the contractor under the same contract or any other contract with the Project Manager of the IIMB or any contracting person through the Project Manager pending finalization of adjudication of any such claim.

It is an agreed term of the contract that the sum of money or moneys so withheld or retained under the lien referred to above by the Project Manager or IIMB will be kept withheld or retained as such by the Project Manager or IIMB till the claim arising out of or under the contract is determined by the arbitrator(if the contract is governed by the arbitration clause) by the competent court, as the case may be and that the contractor will have no claim for interest or damages whatsoever on any account in respect of such withholding or retention under the lien referred to above and duly notified as such to the contractor. For the purpose of this clause, where the contractor is a partnership firm or a limited company, the Project Manager or the IIMB shall be entitled to withhold and also have a lien to retain towards such claimed amount or amounts in whole or in part from any sum found payable to any partner/limited company as the case may be, whether in his individual capacity or otherwise.

(ii) IIMB shall have the right to cause an audit and technical examination of the works and the final bills of the contractor including all supporting vouchers, abstract, etc., to be made after payment of the final bill and if as a result of such audit and technical examination any sum is found to have been overpaid in respect of any work done by the contractor under the contract or any work claimed to have been done by him under the contract and found not to have been executed, the contractor shall be liable to refund the amount of over-payment and it shall be lawful for IIMB to recover the same from him in the manner prescribed in sub-clause (i) of this clause or in any other manner legally permissible; and if it is found that the contractor was paid less than what was due to him under the contract in respect of any work executed by him under it, the amount of such under payment shall be duly paid by IIMB to the contractor, without any interest thereon whatsoever.

Provided that the IIMB shall not be entitled to recover any sum overpaid, nor the contractor shall be entitled to payment of any sum paid short where such payment has been agreed upon between the Project Manager on the one hand and the contractor on the other under any term of the contract permitting payment for work after assessment by the Project Manager.

CLAUSE 29A

Lien in respect of claims in other Contracts

Any sum of money due and payable to the contractor (including the security deposit returnable to him) under the contract may be withheld or retained by way of lien by the Project Manager or the IIMB or any other contracting person or persons through Project Manager against any claim of the Project Manager or IIMB or such other person or persons in respect of payment of a sum of money arising out of or under any other contract made by the contractor with the Project Manager or the IIMB or with such other person or persons.

It is an agreed term of the contract that the sum of money so withheld or retained under this clause by the Project Manager or the IIMB will be kept withheld or retained as such by the Project Manager or the IIMB or till his claim arising out of the same contract or any other contract is either mutually settled or determined by the arbitration clause or by the competent court, as the case may be and that the contractor shall have no claim for interest or damages whatsoever on this account or on any other ground in respect of any sum of money withheld or retained under this clause and duly notified as such to the contractor.

CLAUSE 30: (Not Applicable in the Contract)

CLAUSE 31

Unfiltered water supply

The contractor(s) shall make his/their own arrangements for water required for the work and nothing extra will be paid for the same. This will be subject to the following conditions.

i) That the water used by the contractor(s) shall be fit for construction purposes to the satisfaction of the Project Manager.

ii) The Project Manager shall make alternative arrangements for supply of water at the risk and cost of contractor(s) if the arrangements made by the contractor(s) for procurement of water are in the opinion of the Project Manager, unsatisfactory.

CLAUSE 31 A

Departmental water supply, if available

Water if available may be supplied to the contractor by the department subject to the following conditions:-

i) The Electrical charges as per actual consumption and rate as per prevailing BESCOM Charges.

ii) The contractor(s) shall make his/their own arrangement of water connection and laying of pipelines from existing main of source of supply.

The Department do not guarantee to maintain uninterrupted supply of water and it will be incumbent on the contractor(s) to make alternative arrangements for water at his/ their own cost in the event of any temporary break down in the IIMB water main so that the progress of his/their work is not held up for want of water. No claim of damage or refund of water charges will be entertained on account of such break down.

CLAUSE 32

Alternate water arrangements

i) Where there is no piped water supply arrangement and the water is taken by the contractor from the wells or hand pump constructed by the IIMB, no charge shall be recovered from the contractor on that account. The contractor shall, however, draw water at such hours of the day that it does not interfere with the normal use for which the hand pumps and wells are intended. He will also be responsible for all damages and abnormal repairs arising out of his use, the cost of which shall be recoverable from him. The Project Manager shall be the final authority to determine the cost recoverable from the contractor on this account and his decision shall be binding on the contractor.

The contractor shall be allowed to construct temporary wells in IIMB land for taking water for construction purposes only after he has got permission of the Project Manager in writing. No charges shall be recovered from the contractor on this account, but the contractor shall be required to provide necessary safety arrangements to avoid any accidents or damages to adjacent buildings, roads and service lines. He shall be responsible for any accidents or damages caused due to construction and subsequent maintenance of the wells and shall restore the ground to its original condition after the wells are dismantled on completion of the work

CLAUSE 33

Return of Surplus materials

Notwithstanding anything contained to the contrary in this contract, where any materials for the execution of the contract are procured with the assistance of IIMB either by issue from IIMB stocks or purchase made under orders or permits or licenses issued by IIMB, the contractor shall hold the said materials economically and solely for the purpose of the contract and not dispose of them without the written permission of the IIMB and return, if required by the Project Manager, all surplus or unserviceable materials that may be left with him after the completion of the contract or at its termination for any reason whatsoever on being paid or credited such price as the Project Manager shall determine having due regard to the condition of the materials. The price allowed to the contractor however shall not exceed the amount charged to him excluding the element of storage charges. The decision of the Project Manager shall be final and conclusive. In the event of breach of the aforesaid condition, the contractor shall in addition to throwing himself open to action for contravention of the terms of the license or permit and/or for criminal breach of trust, be liable to IIMB for all moneys, advantages or profits resulting or which in the usual course would have resulted to him by reason of such breach.

CLAUSE 34

Hire of Plant & Machinery

i) The contractor shall arrange at his own expense all tools, plant, machinery and equipment (hereinafter referred to as T&P) required for execution of the work except for the Plant & Machinery listed in Schedule 'C' and stipulated for issue to the contractor. If the contractor requires any item of T&P on hire from the T&P available with the IIMB over and above the T&P stipulated for issue, the IIMB will, if such item is available, hire it to the contractor at rates to be

agreed upon between him and the Project Manager. In such a case, all the conditions hereunder for issue of T&P shall also be applicable to such T&P as is agreed to be issued.

ii) Plant and Machinery when supplied on hire charges shown in Schedule 'C' shall be made over and taken back at the departmental equipment yard/shed shown in Schedule 'C' and the contractor shall bear the cost of carriage from the place of issue to the site of work and back. The contractor shall be responsible to return the plant and machinery with condition in which it was handed over to him, and he shall be responsible for all damage caused to the said plant and machinery at the site of work or elsewhere in operation and otherwise during transit including damage to or loss of plant and for all losses due to his failure to return the same soon after the completion of the work for which it was issued. The Project Manager shall be the sole judge to determine the liability of the contractor and its extent in this regard and his decision shall be final and binding on the contractor.

iii) The plant and machinery as stipulated above will be issued as and when available and if required by the contractor. The contractor shall arrange his programme of work according to the availability of the plant and machinery and no claim, whatsoever, will be entertained from him for any delay in supply by the Department.

iv) The hire charges shall be recovered at the prescribed rates from and inclusive of the date the plant and machinery made over up to and inclusive of the date of the return in good order even though the same may not have been working for any cause except major breakdown due to no fault of the contractor or faulty use requiring more than three working days continuously (excluding intervening holidays and Sundays) for bringing the plant in order. The contractor shall immediately intimate in writing to the Project Manager when any plant or machinery gets out of order requiring major repairs as aforesaid. The Project Manager shall record the date and time of receipt of such intimation in the log sheet of the plant or machinery. Based on this, if the breakdown before lunch period or major breakdown will be computed considering half a day's breakdown on the day of complaint. If the breakdown occurs in the post lunch period of major breakdown will be computed starting from the next working day. In case of any dispute under this clause, the decision of the Director, IIMB shall be final and binding on the contractor.

v) The hire charges shown above are for each day of 8 hours (inclusive of the one hour lunch break) or part thereof.

vi) Hire charges will include service of operating staff as required and also supply of lubricating oil and stores for cleaning purposes. Power fuel of approved type, firewood, kerosene oil etc. for running the plant and machinery and also the full time chowkidar for guarding the plant and machinery against any loss or damage shall be arranged by the contractor who shall be fully responsible for the safeguard and security of plant and machinery. The contractor shall on or before the supply of plant and machinery sign an agreement indemnifying the Department against any loss or damage caused to the plant and machinery either during transit or at site of work

vii) Ordinarily, no plant and machinery shall work for more than 8 hours a day inclusive of one hour lunch break. In case of an urgent work however, the Project Manager may, at his discretion, allow the plant and machinery to be worked for more than normal period of 8 hours a day. In that case, the hourly hire charges for overtime to be borne by the contractor shall be 50% more than the normal proportionate hourly charges (1/8th of the daily charges) subject to a minimum of half day's normal charges on any particular day. For working out hire charges for over time, a period of half an hour and above will be charged as one hour and a period of less than half an hour will be ignored.

viii) The contractor shall release the plant and machinery every seventh day for periodical servicing and/or wash out which may take about three to four hours or more. Hire charges for full day shall be recovered from the contractor for the day of servicing/ wash out irrespective of the period employed in servicing.

ix) The plant and machinery once issued to the contractor shall not be returned by him on account of lack of arrangements of labor and materials, etc. on his part, the same will be returned only when they are required for major repairs or when in the opinion of the Project Manager, the work or a portion of work for which the same was issued is completed.

x) Log Book for recording the hours of daily work for each of the plant and machinery supplied to the contractor will be maintained by the Department and will be countersigned by the contractor or his authorized agent daily. In case the contractor contests the correctness of the entries and/or fails to sign the Log Book, the decision of the Project Manager shall be final and binding on him. Hire charges will be calculated according to the entries in the Log Book and will be binding on the contractor. Recovery on account of hire charges for road rollers shall be made for the minimum number of days worked out on the assumption that a roller can consolidate per day and maximum quantity of materials or area surfacing as noted.

xi) In the case of concrete mixers, the contractors shall arrange to get the hopper cleaned and the drum washed at the close of the work each day or each occasion.

a. In case, rollers for consolidation are employed by the contractor himself, log book for such rollers shall be maintained in the same manner as is done in case of departmental rollers, maximum quantity of any items to be consolidated for each roller-day shall also be same as in Annexure to Clause 34(x). For less use of rollers, recovery for the less roller days shall be made at the stipulated issue rate.

xii) The contractor shall be responsible to return the plant and machinery in the condition in which it was handed over to him and he shall be responsible for all damage caused to the said plant and machinery at the site of work or elsewhere in operation or otherwise or during transit including damage to or loss of parts, and for all losses due to his failure to return the same, soon after the completion of the work, for which it was issued. The Project Manager shall be the sole judge to determine the liability of the contractor and its extent in this regard and his decision shall be final and binding on the contractor.

xiii) The contractor will be exempted from levy of any hire charges for the number of days he is called upon in writing by the Project Manager to suspend execution of the work, provided IIMB plant and machinery in question have, in fact, remained idle with the contractor because of the suspension

xiv) In the event of the contractor not requiring any item of plant and machinery issued by IIMB though not stipulated for issue in Schedule 'C' any time after taking delivery at the place of issue, he may return it after two days written notice or at any time without notice if he agrees to pay hire charges for two additional days without, in any way, affecting the right of the Project Manager to use the said plant and machinery during the said period of two days as he likes including hiring out to a third party.

CLAUSE 35

Condition relating to use of asphaltic materials

i) The contractor undertakes to make arrangement for the supervision of the work by the firm supplying the tar or bitumen used.

ii) The contractor shall collect the total quantity of tar or bitumen required for the work as per standard formula, before the process of painting is started and shall hypothecate it to the Project Manager. If any bitumen or tar remains unused on completion of the work on account of lesser use of materials in actual execution for reasons other than authorized changes of specifications and abandonment of portion of work, a corresponding deduction equivalent to the cost of unused materials as determined by the Project Manager shall be made and the material return to the contractors. Although the materials are hypothecated to IIMB, the contractor undertakes the responsibility for their proper watch, safe custody and protection against all risks. The materials shall not be removed from site of work without the consent of the Project Manager in writing.

iii) The contractor shall be responsible for rectifying defects noticed within a year from the date of completion of the work and the portion of the security deposit relating to asphaltic work shall be refunded after the expiry of this period.

CLAUSE 36

Employment of Technical Staff and employees

Contractors Superintendence, Supervision, Technical Staff & Employees

i) The contractor shall provide all necessary superintendence during execution of the work and all along thereafter as may be necessary for proper fulfilling of the obligations under the contract.

The contractor shall immediately after receiving letter of acceptance of the tender and before commencement of the work, intimate in writing to the Project Manager, the name(s), qualifications, experience, age, address(s) and other particulars along with certificates, of the principal technical representative to be in charge of the work and other technical representative(s) who will be supervising the work. Minimum requirement of such technical representative(s) and their qualifications and experience shall not be lower than specified in Schedule 'F'. The Project Manager shall within 3 days of receipt of such communication, intimate in writing his approval or otherwise of such a representative(s) to the contractor. Any such approval may at any time be withdrawn and in case of such withdrawal, the contractor shall appoint another such representative(s) according to the provisions of this clause.

Decision of the tender accepting authority shall be final and binding on the contractor in this respect. Such a principal technical representative and other technical representative(s) shall be appointed by the contractor soon after receipt of the approval from Project Manager and shall be available at site before start of work.

All the provisions applicable to the principal technical representative under the Clause will also be applicable to other technical representative(s) The principal technical representative and other technical representative(s) shall be present at the site of work for supervision at all times when any construction activity is in progress and also present himself/themselves, as required, to the Project Manager and/or his designated representative to take instructions. Instructions given to the principal technical representative or other technical representative(s) shall be deemed to have the same force as if these have been given to the contractor. The principal technical representative and other technical representative(s) shall be actually available at site fully during all stages of execution of work, during recording/checking/test checking of measurements of works and whenever so required by the Project Manager and shall also note down instructions conveyed by the Project Manager or his designated representative(s) in the site order book and shall affix his/their signature in token of noting down the instructions and in token of acceptance of measurements/ checked measurements/ test checked measurements. The representative(s) shall not look after any other work. Substitutes, duly approved by Project Manager of the work, in similar manner as aforesaid shall be provided in event of absence of any of the representative(s) by more than two days.

If the Project Manager, whose decision in this respect is final and binding on the contractor, is convinced that no such technical representative(s) is/are effectively appointed or is/are effectively attending or fulfilling the provision of this clause, a recovery (non- refundable) shall be effected from the contractor as specified in Schedule 'F' and the decision of the Project Manager as recorded in the site order book and measurement recorded checked/test checked in Measurement Books shall be final and binding on the contractor. Further if the contractor fails to appoint suitable technical Principal technical representative and/or other technical representative(s) and if such appointed persons are not effectively present or are absent by more than two days without duly approved substitute or do not discharge their responsibilities satisfactorily, the Project Manager shall have full powers to suspend the execution of the work until such date as suitable other technical representative(s) is/are appointed and the contractor shall be held responsible for the delay so caused to the work. The contractor shall submit a certificate of employment of the technical representative(s) (in the form of copy of Form-16 or CPF deduction issued to the Engineers employed by him) along with every on account bill final bill and shall produce evidence if at any time so required by the Project Manager.

ii) The contractor shall provide and employ on the site only such technical assistants as are skilled and experienced in their respective fields and such foremen and supervisory staff as are competent to give proper supervision to the work.

The contractor shall provide and employ skilled, semiskilled and unskilled labor as is necessary for proper and timely execution of the work.

The Project Manager shall be at liberty to object to and require the contractor to remove from the works any person who in his opinion misconducts himself, or is incompetent or negligent in the performance of his duties or whose employment is otherwise considered by the Project Manager to be undesirable. Such person shall not be employed again at works site without the written permission of the Project Manager and the persons so removed shall be replaced as soon as possible by competent substitutes.

CLAUSE 37

Levy/Taxes payable by Contractor

i) GST, Building and other Construction Workers Welfare Cess or any other tax, levy or Cess in respect of input for or output by this contract shall be payable by the contractor and IIMB shall not entertain any claim whatsoever in this respect except as provided under Clause 38.

ii) The contractor shall deposit royalty and obtain necessary permit for supply of the red bajri, stone, kankar, etc. from local authorities.

If pursuant to or under any law, notification or order any royalty, cess or the like becomes payable by the IIMB of India and does not any time become payable by the contractor to the State IIMB, Local authorities in respect of any material used by the contractor in the works, then in such a case, it shall be lawful to the IIMB of India and it will have the right and be entitled to recover the amount paid in the circumstances as aforesaid from dues of the contractor.

CLAUSE 38

Conditions for reimbursement of levy/taxes if levied after receipt of tenders

(i) All tendered rates shall be inclusive any tax, levy or cess applicable on last stipulated date of receipt of tender including extension if any. No adjustment i.e. increase or decrease shall be made for any variation in the rate of GST, Building and Other Construction Workers Welfare Cess or any tax, levy or cess applicable on inputs.

However, effect of variation in rates of GST or Building and Other Construction Workers

Welfare Cess or imposition or repeal of any other tax, levy or cess applicable on output of the works contract shall be adjusted on either side, increase or decrease.

Provided further that for Building and Other Construction Workers Welfare Cess or any tax (other than GST), levy or cess varied or imposed after the last date of receipt of tender including extension if any, any increase shall be reimbursed to the contractor only if the contractor necessarily and properly pays such increased amount of taxes/levies/ cess.

Provided further that such increase including GST shall not be made in the extended period of contract for which the contractor alone is responsible for delay as determined by authority for extension of time under Clause 5 in Schedule F.

(ii) The contractor shall keep necessary books of accounts and other documents for the purpose of this condition as may be necessary and shall allow inspection of the same by a duly authorized representative of the IIMB and/or the Project Manager and shall also furnish such other information/document as the Project Manager may require from time to time.

(iii) The contractor shall, within a period of 30 days of the imposition of any such further tax or levy or cess, give a written notice thereof to the Project Manager that the same is given pursuant to this condition, together with all necessary information relating thereto.

CLAUSE 39

Termination of Contract on death of contractor

Without prejudice to any of the rights or remedies under this contract, if the contractor dies, the PMC Project Manager on behalf of the Director IIMB shall have the option of terminating the contract without compensation to the contractor.

CLAUSE 40

If relative working in IIMB then the contractor not allowed to tender

The contractor shall not be permitted to tender for works in IIMB responsible for award and execution of contracts in which his near relative is posted as Divisional Accountant or as an Project Manager in any capacity between the grades of the Director, IIMB . He shall also intimate the names of persons who are working with him in any capacity or are subsequently employed by him and who are near relatives to any Gazetted Project Manager in the IIMB. Any breach of this condition by the contractor would render him liable to be removed from the approved list of contractors of this Department. If however, the contractor is registered in any other department; he shall be debarred from tendering in IIMB for any breach of this condition.

NOTE: By the term “near relatives” is meant wife, husband, parents and grandparents, children and grandchildren, brothers and sisters, uncles, aunts and cousins and their corresponding in-laws.

CLAUSE 41: (Not Applicable in the Contract)

CLAUSE 42

Return of material & recovery for excess material issued

(i) After completion of the work and also at any intermediate stage in the event of non- reconciliation of materials issued, consumed and in balance - (see Clause 10), theoretical quantity of materials issued by the IIMB for use in the work shall be calculated on the basis and method given hereunder:-

a. Quantity of cement & bitumen shall be calculated on the basis of quantity of cement & bitumen required for different items of work as shown in the Schedule of Rates mentioned in Schedule ‘F’. In case any item is executed

for which standard constants for the consumption of cement or bitumen are not available in the above mentioned schedule/statement or cannot be derived from the same shall be calculated on the basis of standard formula to be laid down by the Project Manager.

b. Theoretical quantity of steel reinforcement or structural steel sections shall be taken as the quantity required as per design or as authorized by Project Manager, including authorized lappages, chairs etc. plus 3% wastage due to cutting into pieces, such theoretical quantity being determined and compared with the actual issues each diameter wise, section wise and category wise separately.

c. Theoretical quantity of G.I. & C.I. or other pipes, conduits, wires and cables, pig lead and G.I./M.S. sheets shall be taken as quantity actually required and measured plus 5% for wastage due to cutting into pieces (except in the case of G.I./M.S. sheets it shall be 10%), such determination & comparison being made diameter wise & category wise.

d. For any other material as per actual requirements.

(ii) Over the theoretical quantities of materials so computed a variation shall be allowed as specified in Schedule 'F'. The difference in the net quantities of material actually issued to the contractor and the theoretical quantities including such authorized variation, if not returned by the contractor or if not fully reconciled to the satisfaction of the Project Manager within fifteen days of the issue of written notice by the Project Manager to this effect, shall be recovered at the rates specified in Schedule 'F', without prejudice to the provision of the relevant conditions regarding return of materials governing the contract. Decision of Project Manager in regard to theoretical quantities of materials, which should have been actually used as per the Annexure of the standard schedule of rates and recovery at rates specified in Schedule 'F', shall be final & binding on the contractor.

For nonscheduled items, the decision of the Director, IIMB regarding theoretical quantities of materials which should have been actually used, shall be final and binding on the contractor.

(iii) The said action under this clause is without prejudice to the right of the IIMB to take action against the contractor under any other conditions of contract for not doing the work according to the prescribed specifications.

CLAUSE 43

Compensation during warlike situations

The work (whether fully constructed or not) and all materials, machines, tools and plants, scaffolding, temporary buildings and other things connected therewith shall be at the risk of the contractor until the work has been delivered to the Project Manager and a certificate from him to that effect obtained. In the event of the work or any materials properly brought to the site for incorporation in the work being damaged or destroyed in consequence of hostilities or warlike operation, the contractor shall when ordered (in writing) by the Project Manager to remove any debris from the site, collect and properly stack or remove in store all serviceable materials salvaged from the damaged work and shall be paid at the contract rates in accordance with the provision of this agreement for the work of clearing the site of debris, stacking or removal of serviceable material and for reconstruction of all works ordered by the Project Manager, such payments being in addition to compensation up to the value of the work originally executed before being damaged or destroyed and not paid for. In case of works damaged or destroyed, but not already measured and paid for, the compensation shall be assessed by the PMC Project Manager up to Rs.5,000/- and by the Director, IIMB concerned for a higher amount. The contractor shall be paid for the damages/destruction suffered and for restoring the material at the rate based on analysis of rates tendered for in accordance with the provision of the contract. The certificate of the Project Manager regarding the quality and quantity of materials and the purpose for which they were collected shall be final and binding on all parties to this contract.

Provided always that no compensation shall be payable for any loss in consequence of hostilities or warlike operations (a) unless the contractor had taken all such precautions against air raid as are deemed necessary by the A.R.P. Project Managers or the Project Manager (b) for any material etc. not on the site of the work or for any tools, plant, machinery, scaffolding, temporary building and other things not intended for the work.

In the event of the contractor having to carry out reconstruction as aforesaid, he shall be allowed such extension of time for its completion as is considered reasonable by the PMC Project Manager.

CLAUSE 44

Apprentices Act provisions to be complied with

The contractor shall comply with the provisions of the Apprentices Act, 1961 and the rules and orders issued thereunder from time to time. If he fails to do so, his failure will be a breach of the contract and the Director, IIMB may, in his discretion, cancel the contract. The contractor shall also be liable for any pecuniary liability arising on account of any violation by him of the provisions of the said Act.

CLAUSE 45

Release of Security deposit after labor clearance

Release of Security Deposit of the work shall not be refunded till the contractor produces a clearance certificate from the Labor Project Manager. As soon as the work is virtually complete, the contractor shall apply for the clearance certificate to the Labor Project Manager under intimation to the Project Manager. The Project Manager, on receipt of the said communication, shall write to the Labor Project Manager to intimate if any complaint is pending against the contractor in respect of the work. If no complaint is pending, on record till after 3 months after completion of the work and/or no communication is received from the Labor Project Manager to this effect till six months after the date of completion, it will be deemed to have received the clearance certificate and the Security Deposit will be released if otherwise due.

Additional Conditions of Contract

1) Rates quoted for items shall be inclusive of Royalty and all other taxes, which are in force or levied from time to time or become leviable / payable by him to any authority. Royalty will be deducted from the running account bills at the prescribed rates.

a. The unit rates quoted by the contractor are to be considered as inclusive of royalty (or segrierage) in respect of various bridges materials viz., Granite size stone, boulders, metal sand, gravel, etc. and laid by the contractor for the execution of the several item of works irrespective of the source, whether Government quarry or private quarry from where the materials are obtained by him. The Government shall deduct from the bills payable to the contractor such royalty payable by him. The rates shall also be inclusive of all other taxes that may exist or become leviable payable by him to any authority.

The recovery of royalty shall be made at the rates as shown in the schedule attached hereof, whether or not such rates of royalty are generally increased or decreased by the Government. The recovery of royalty shall be made on the RMC Supplies also.

The Contractor shall be liable to pay all royalties chargeable on Government Local Bodies or company materials required for the work.

The Royalty recovered will be remitted to state government department.

Sl.no.	Materials	Royalty per Metric ton (Rs.)	Conversion co-efficient to Cmt	Royalty per Cmt (Rs.)
1	Size stone	70	1cmt=2.63 tons	184
2	Laterite stone	60	1cmt=1.8 tons	108
3	Metal/Aggregates	70	1cmt=1.8 tons	126
4	Sand	80	1cmt=1.72 tons	138
5	Gravels/murrum	40	1cmt=1.5 tons	60
6	Soil (all types)	60	1cmt=1.5 tons	90

2) The Contractor shall at his own cost provide night watchmen at all parts of the work where necessary. He shall also keep all open trenches, excavation or other dangerous places properly and sufficiently lighted between sunset and sunrise and shall provide and fix proper fencing, hoarding and temporary bridges to protect and assist the public traffic. The Contractor shall also at his own cost erect temporary fences on the site of works where required by the Engineer.

3) Night works will be permitted subject to obtaining prior approval from IIMB. However, no additional payment will be made for night work.

4) INSURANCE AND INDEMNITIES:

Insurance of Works:

Contractor shall provide for adequate cover to his employees as per provisions of Workmen's Compensation Act in force. The Contractor shall ensure that his insurance includes for all liabilities, which should cover material and building damage, workmen’s compensation, third party liabilities etc. All the above-mentioned insurance can be covered by CAR Policy for the Contract Value. The Contractor should produce evidence of insurance coverage for all above before submitting invoices for payment. Such insurance shall be affected with an insurer and in the terms approved by IIMB within 21 days from the date of receipt of LOA.

If the Contractor has a blanket insurance policy for all his works and the policy covers all the items to be insured under this Contract, the Contractor may assign such policy/ policies in favour of Indian Institute of Management Bangalore, in lieu of taking out fresh policies in the name of Indian Institute of Management Bangalore.

Insurance against accident or injury to Workers: IIMB shall not be liable for or in respect of any damage or compensation payable at law in respect or in consequence of any accident or injury to any workmen or other person or any Sub-Contractor. The Contractor shall indemnify and keep indemnified IIMB against all such damages and compensation, and against all liability, claims, proceeding, costs, charges and expenses whatsoever in respect thereof or in relation thereto. The Validity of CAR Policy shall be till the Virtual Completion of the works.

5) Payment in respect of work done will be based on certificate from Engineer-in-charge as to the value of work done. This certificate should be supported by a bill from the contractor indicating the quantities of work done and rates adopted for evaluation of the work or percentage of work.

The payment will be made by account transfer / as per norms in force, within 30 days from the receipt by the Accounts Dept. with all necessary certification/approvals/Auditing etc.

The contractor should enclose color photographs / drone pictures of the items of work done at site for the period in all RA bills, final bills and to be submitted in three sets of hard copies after Auditing.

Memorandum of Payment:

a. Total value of work done ----------
b. Deduct total value of the work done up to previous bills ---
c. Deduct for retention amount ……5%
d. Deduct for Income Tax ---------- 2%
e. Deduct for Labor welfare cess ---------- 1%
f. Deduct for Material advance paid if any. ----------
g. Deduct for Mobilization advance with interest, if any. ------
h. Deduction of Electricity & water charges supplied, if any---
i. Liquidated damages if any----------
j. Bonus clause amount if any----------
k. Any other dues recoverable by IIMB from the Contractor under the present or any other contract.----------
l. Royalty on materials.
m. During the progress of work for each contract the contractor shall prefer claims giving details of work done, rate and value to the Engineer-in-charge. These claims are called RAR bills and RAR payments will be normally made once in a calendar month. These bills will be checked by the Engineer-in-Charge with reference to either the percentage of the value of work done or on the basis of actual measurements wherever available and recommend payment of the bill with due adjustment for recoveries and RAR payment (including material advance) effected.

Please note no cost will be paid for any delayed payments.

6) Laboratory:

The contractor has to setup a laboratory at site at his cost with equipment's or should furnish MOU with reputed NABL accredited labs.

7) Site office for the Employers/Architects Engineers:

The contractor shall construct and provide free of charge on office with a carpet area of approximately 800 Sq.ft. a waterproof office with tables, chairs, fans and light with toilet facility and light motor vehicle for use by the Clients / Project Engineer, Project Engineer's Representative, Architects and their supervision team on works and for co-ordination. The office shall be constructed within the time stipulated by. On completion of the project works, the site office will be formally handed over to the owner free of charge by the contractor and will thereupon become the absolute property of the owner.

8)

a. Telephone.

The contractor shall make his own arrangements for telephone connection at the site which should be accessible for the use of the Owner / Project Adviser / Project manager – IIM / Project Engineer – PMC / Architects / Consultants and their representatives.

b. The contractor should make necessary transport arrangement to the project team for inspection of testing facilities, RMC plants, approval of materials, random verification deposits made to labor department, Mines and geology.

9) Temporary Roads

The contractor shall construct and maintain at his own cost all suitable temporary roads at the work site for the use of his transport equipment and also the vehicles of the Owner / Project Adviser / Project manager – IIM / Project Engineer – PMC / Architects / Consultants and their representatives.

Logistics for materials, transport and stacking to be arranged by contractor only. No Cost will be paid on these works by IIMB.

10) The Contractor will not be permitted to make use of any space other than the working space allotted to him without the specific written permission of the Employer.

11) The security of the Contractor's equipment and materials is his own responsibility. The Employer accepts no liability for loss or damage to the Contractor's plant, tools or materials.

12) The Contractor shall ensure that the Security Regulations of the Employer is strictly enforced.

First Aid: The Contractor shall be responsible for all first aid and he shall keep the site fully equipped as per relevant safety norms in force.

13) Site Working Conditions

The contractor shall at his own cost provide suitable residential accommodation for his staff and labor. Land will not be provided within the Institute premises for putting up labor sheds.

Contractor will arrange for ration cards and permits as necessary for labor.

Provision for temporary toilets, urinals and bathing areas should be made for staff and labor by the contractor within the living area. These should be maintained in a clean and orderly condition and comply with local and Central Government regulations.

None of the staff, laborers, sub-contractors etc.; of the main contractors are allowed within the existing Indian Institute of Management buildings, canteen, offices, etc; if any. They should be confined to the areas of work for which the contract is called for.

Contractor, staff and labor should strictly follow the IIMB regulations in existence or to be formed for purpose of entry of labor and material, working conditions, hours of working etc;

14) **INSPECTION**

The Work of the Contractor is subject to inspection by the Employer at all times, but such inspections do not relieve the Contractor of any of his responsibilities.

The Precast unit along with facilities as per contract will be inspected by PM team before issuing

LOA will be organized by Contractors

15) REPORTING

From the Date of Commencement of the Contract, the Contractor must report the following information to the Employer in writing each Friday, until the Date of Completion:

Man power employed: managerial, supervisory and workmen (by trades).

Progress achieved, weekly progress to be furnished.if required drone survey mapping of work progress to be furnished as and when required by the project.

All RA bills should be attached with work done photos if required drone mapping of work

Expected dates for completion of various phases of the Work.

Any actual or potential delay in programme caused by the action or inaction of the Employer/ Architect and other contractors working on Site.

16) Its responsibility of contractors to take care of their labour & employees during the constructions towards injury /death caused by wild animal apart form the labour insurance etc / car policy etc.

17) All instrument required for the survey works should be arrange by contractor/ Including survey by drone etc.

18) Contractor should provide & Insist on covid norms as per statutory GOI enforce for their labour & employees by providing sanitizer ,mask & social distancing on works and labour sheds.

19) Contractor should furnish their third party test on materials suggested by project manager from reputed /NABL accredited laboratories .

20) Contractor should engage third party for conducting rebound hammer and ultra sound pulse velocity test on RCC /precast member as when required by the project team.

21) The Precast unit associated with contractor will be inspected by the project team before starting the production.

22) The Running account/materials advance bills will be considered for monthly cycle and payments will be made online within three week from the date of submission to account section.

23) The Contractor should make arrangements for requirements of electricity and water supply on works @ site.

24) If contractor avails electricity power from the institute same will be recovered in the RA bills as per consumption readings in energy meter.

25) Contractor should take safety measures against attack/injury/caused by wild animals on their staff and labour @ site , including necessary compensation on death.

INTEGRITY PACT

To,

Project Manager,

……..,

……..

Sub: Submission of Tender for the work of ……...……....

Dear Sir,

I/We acknowledge that IIMB is committed to follow the principles thereof as enumerated in the Integrity Agreement enclosed with the tender/bid document.

I/We agree that the Notice Inviting Tender (NIT) is an invitation to offer made on the condition that I/We will sign the enclosed integrity Agreement, which is an integral part of tender documents, failing which I/We will stand disqualified from the tendering process. I/We acknowledge that THE MAKING OF THE BID SHALL BE REGARDED AS AN UNCONDITIONAL AND ABSOLUTE ACCEPTANCE of this condition of the NIT.

I/We confirm acceptance and compliance with the Integrity Agreement in letter and spirit and further agree that execution of the said Integrity Agreement shall be separate and distinct from the main contract, which will come into existence when tender/bid is finally accepted by IIMB. I/We acknowledge and accept the duration of the Integrity Agreement, which shall be in the line with Article 1 of the enclosed Integrity Agreement.

I/We acknowledge that in the event of my/our failure to sign and accept the Integrity Agreement, while submitting the tender/bid, IIMB shall have unqualified, absolute, and unfettered right to disqualify the tenderer/bidder and reject the tender/bid is accordance with terms and conditions of the tender/ bid.

Yours faithfully

(Duly authorized signatory of the Bidder)

To be signed by the bidder and same signatory competent / authorized to sign the relevant contract on behalf of CPWD.

INTEGRITY AGREEMENT

This Integrity Agreement is made at ..... on this ..... day of ..... 20.....

BETWEEN

Director, IIMB represented through CAO,

.....,

(Name of Division)

IIMB, ..., (Hereinafter referred

(Address of Division)

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

AND

.....

(Name and Address of the Individual/firm/Company)

through ..... (Hereinafter referred to (Details of duly authorized signatory)

as the **"Bidder/Contractor"** and which expression shall unless repugnant to the meaning or context hereof include its successors and permitted assigns)

Preamble

WHEREAS the Principal / Owner has floated the Tender (NIT No.) (hereinafter referred to as "Tender/Bid") and intends to award, under laid down organizational procedure, contract for

.....

(Name of work)

hereinafter referred to as the "Contract".

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

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

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

Article 1: Commitment of the Principal/Owner

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

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

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

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

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

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

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

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

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

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

(c) The Bidder(s)/Contractor(s) will not commit any offence under the relevant IPC/PC Act. Further the Bidder(s)/ Contract(s) will not use improperly, (for the purpose of competition or personal gain), or pass on to others, any information or documents provided by the Principal/Owner as part of the business relationship, regarding plans, technical proposals, and business details, including information contained or transmitted electronically.

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

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

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

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

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

Article 3: Consequences of Breach

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

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

2) Forfeiture of EMD/Performance Guarantee/Security Deposit: If the Principal/Owner has disqualified the Bidder(s) from the Tender process prior to the award of the Contract or terminated/determined the Contract or has accrued the right to terminate/determine the Contract according to Article 3(1), the Principal/Owner apart from exercising any legal rights that may have accrued to the Principal/Owner, may in its considered opinion forfeit the entire amount of Earnest Money Deposit, Performance Guarantee and Security Deposit of the Bidder/Contractor.

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

Article 4: Previous Transgression

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

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

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

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

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

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

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

Article 6- Duration of the Pact

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

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

Article 7- Other Provisions

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

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

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

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

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

Article 8- LEGAL AND PRIOR RIGHTS

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

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

.....

(For and on behalf of Principal/Owner)

.....

(For and on behalf of Bidder/Contractor) WITNESSES:

1. .....

(Signature, name and address)

2. .....

(signature, name and address)

Place:

Dated :

AGREEMENT (subjected to GOI Norms)

This Agreement ("**Agreement**") is executed on the…….. ("**Effective Date**")at Bangalore

Between

Indian Institute of Management Bangalore , an Institute of National Importance declared under the Indian Institutes of Management Act, 2017 having its registered office at Bilekahalli, Bannerghatta Road, Bangalore - 560076, represented through its Director (hereinafter called "**IIMB**", which expression shall include its successors and assigns wherever the context or meaning shall so require or permit) of the **One Part**;

And

……a company registered under Company Act 2013, and applicable laws of India and having its registered Office at…… (hereinafter called the "Contractor", which expression shall include its successors and assigns wherever the context or meaning shall so require or permit) of the **Other Part**.

IIMB and the Contractor shall be individually referred to as "**1st Party**" and "**2nd Party**" respectively and jointly as "**Parties**".

Whereas:

- IIMB through the Tender dated ……**dated……..** ("**Tender**" which shall include all annexures and schedules so attached) invited reputed bidders for executing the works in connection with ……"**Works/s**" Services).
- The Contractor was chosen as the successful bidder and is issued the Letter of Award vide LOA NO: ……..dated ……..("**Letter of Award**"), pursuant to which the Parties shall now enter into the terms and conditions stated herein under the terms of which the Contractor agrees to complete the Works as stated herein below.

- IIMB and the Contractor agree to bind themselves on the terms and conditions hereinafter mutually agreed to.

In consideration of the mutual promises and covenants, the adequacy of which is acknowledged, the Parties agree to this Agreement as follows:

1. **Engagement:** IIMB hereby engages the Contractor pursuant to the Letter of Award issued to the Contractor to provide the Services as set forth in the terms of this Agreement. The Contractor acknowledges and agrees that the Services shall be performed and the Works be completed in accordance with the terms of the Tender, including but not limited to the General Conditions of Contract, the Special Conditions of Contract and the terms and conditions contained hereunder. The terms and conditions contained herein are only in addition to the terms contained in the Tender.

2. **Performance of Services**: The Contractor shall comply with the following:

2.1. The Contractor shall fully execute and complete the Works specified in the Tender and Letter of Award within Two (02) months from the date of handing over of the Site;

2.2. The Contractor shall perform and complete the Works in accordance with the terms, including the timelines, contained in the Tender;
2.3. In the event of any changes that may be agreed by IIMB in accordance with the terms contained in the Tender, such changes will be effective only upon IIMB agreeing to the same in writing.
2.4. The Contractor understands and agrees that time is the essence of this Agreement and all timelines and schedules set forth in the Tender, shall be complied and met by the Contractor.
2.5. Without prejudice to the terms contained in the Tender, in the event of any delay in performance of the Services or commencement of the Works, the stipulations relating to such delays set forth in the Tender shall apply.

3. Obligations of Contractor:

3.1. The Contractor shall ensure to comply with all obligations under the Tender, the Letter of Award and the terms contained herein.
3.2. The Contractor shall complete all the Works and Services to the satisfaction of IIMB in accordance with the timelines and instructions as set forth by IIMB.
3.3. The Contractor shall comply with all the applicable laws, rules, regulations, directions, orders, municipal by-laws while performing the Services and completing the Works under this Agreement.
3.4. Without prejudice to the foregoing, the Contractor shall comply with all labor laws and regulations including but not limited to Contract Labour (Regulation and Abolition) Act, 1970, Payment of Wages Act, 1936, Minimum Wages Act, 1948, Employees Provident Fund, Miscellaneous Provisions Act, 1952 and Payment of Gratuity Act, 1972; including payment of wages and employment benefits such as EPF, ESI, bonus as applicable under the applicable laws for the time being in force.
3.5. The Contractor shall ensure that it has adequate insurance with respect to its employees, contractors against any accidents or injuries, including death, caused while performing the Services during the contract period. IIMB shall not be responsible for providing any benefits, insurances, compensation or damages in such instances.
3.6. The Contractor shall facilitate and co-operate with IIMB for any inspection, examination, audit of the Site by IIMB, its personnel or its third-party auditors, as the case may be, which may be conducted as set forth in the terms of the Tender.
3.7. The Contractor acknowledges and agrees that IIMB shall have the right to inspect and audit the performance of the Works on the Site and the Contractor shall co-operate with such inspections.
3.8. The Contractor acknowledges and agrees that IIMB shall have the right to seek relevant records of the Services/works performed anytime during the term of this Agreement or 7 (seven) years upon the expiration of this Agreement and the Contractor shall provide all such details and/access to all such records sought.

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4. **Payment:**

4.1. In consideration of the Works completed to the satisfaction of IIMB, IIMB agrees to pay the Contractor in accordance with the terms agreed in the Tender.

4.2. The Contractor agrees, in accordance with the terms contained in the Tender, that a security deposit of 5% of the value of the invoices will be deducted from the running account bills which will be paid after satisfactory completion of defects liability period of twelve (12) months upon the handover of the Site by the Contractor after the completion of Services, without any interest.

5. **Insurance and indemnities:**

Insurance of works/workers:

As stated in the Tender document, the Contractor shall provide for adequate insurance cover to its employees as per provisions of Workmen's Compensation Act, 1923. The Contractor shall ensure that the said insurance includes all liabilities, which would cover material and building damage, workmen's compensation, third party liabilities etc. **All the above- mentioned insurance can be covered by CAR Policy for the contract value.** The Contractor shall produce evidence of insurance coverage for all works/workers before inception of the works valid up to two (2) months after scheduled completion. Such insurance policy shall be obtained from a reputed insurer and in the terms approved by IIMB; or

If the Contractor has a blanket insurance policy for all his Works and the policy covers all the items to be insured under this Agreement, the Contractor may assign such policy/policies in favour of IIMB.

Insurance against accident or injury to workers or attacking by wild animals: **The Contractor shall provide another insurance policy to his workmen/employees which will protect them and get them the necessary compensation in case of any injury/accident while working which may result in permanent physical disability or death**. IIMB shall not be liable for or in respect of any damage or compensation payable at law in respect or in consequence of any accident or injury to any workmen or other person or any sub-contractor. The Contractor shall indemnify and keep indemnified IIMB against all such damages and compensation, and against all liability, claims, proceeding, costs, charges and expenses.

6. **Indemnity and Limitation of Liability:**

6.1. The Contractor shall indemnify, defend and hold IIMB, its directors, officers, board, employees, staff, consultants harmless, from and against any claims, actions, suits, proceedings, fines, penalties, interests, damages, losses, costs and expenses, including attorney fees arising from: (i) any negligence, misconduct, wilful default on the part of the Contractor; (ii) any fraud, fraudulent misrepresentation made by the Contractor; (iii) bodily injury including any injury (or death) to any worker(s) deployed on the Site; (iv) damage to any IIMB or any third-party property; (v) violation of any applicable laws, rules, regulations, government orders, directions, municipal bylaws by the Contractor; (vi) breach of any covenants, obligations, representations and warranties by the Contractor; (vii) any qualification criteria, information furnished while

bidding or documents produced while bidding becoming false or untrue; and (viii) any violation of the terms of this Agreement or the Tender.

6.2. In no event shall IIMB be liable under any theory of law and whether advised of such liability or not, for any indirect damages whatsoever, including but not limited to special, incidental, consequential, punitive, or exemplary damages or loss of profits. IIMB's total liability under this Agreement shall always be limited to the amounts admittedly due and payable by IIMB for Works that have been completed to IIMB's satisfaction in accordance with the terms set forth in this Agreement..

7. **Confidentiality:** Both the Parties hereby undertake that under no circumstances whatsoever they shall disclose any of the terms of this Agreement and all or any Confidential Information belonging to the other Party, to any third-party, like financial plans, business plans, and other information which is either declared confidential or which is reasonable construed as confidential, to which they might have access during the association with one another in terms of this Agreement, except to the extent that such information is already in public knowledge/domain. The Confidential Information as hereinabove detailed shall not be disclosed during the subsistence of this Agreement and thereafter for a period of five (5) years from the date of expiration or termination for whatever reason.

8. **Termination:**

8.1. IIMB shall have the right to terminate this Agreement in accordance with the provisions contained in the Tender, without providing any reasons thereof, by providing sixty (60) days' notice to the Contractor, without any further liability to IIMB.

8.3. Without prejudice to the foregoing, IIMB shall have the right to terminate this Agreement due to any material breach of the terms contained herein or in the Tender by the Contractor, with a prior notice.

8.4. IIMB shall also have the right to terminate this Agreement immediately, due to any violation of any applicable laws, including but not limited to applicable labour laws, without any further liability to IIMB. In such an event, IIMB shall be entitled to claim all damages, costs, expenses, losses, penalties, interests, fines that may be incurred upon IIMB.

8.5. IIMB shall be entitled to recover the costs and expenses of engaging a third-party to complete the incomplete Works/Services and claim damages for any loss/liability arising out of such non-performance of the Contractor.

9. **Consequence of Expiry or Termination:**

9.1. The Contractor will hand over all deliverables including the Site in a proper and a clean condition as set out in the Tender.

9.2. The Contractor shall immediately, upon expiry or early termination, return or destroy all confidential information in the possession of the Contractor and shall certify in writing that the same has been complied with.

9.3. Upon expiry or termination of this Agreement, IIMB's liability shall be limited to the amount payable for the Services delivered to the satisfaction of IIMB and which have been performed in accordance with the terms set forth herein and in the Tender.

10. **Applicable Law, Jurisdiction and Dispute Resolution:** This Agreement shall be governed and construed in accordance with the Indian Laws and subject to the exclusive jurisdiction of competent courts at Bangalore, India. Any disputes arising under this Agreement shall be resolved in accordance with the provisions of dispute resolution as set forth in the Tender.

11. Miscellaneous:

a. **Relationship of Parties:** Nothing contained in this Agreement shall be construed as creating a partnership between the Parties or as deeming either Party as an agent or representative of or employee of the other. Neither Party may act as the agent of the other Party or incur any liability on behalf of the other Party.

b. **Assignment:** This Agreement shall not be assigned, sublicensed, sold, mortgaged, sub-contracted, or pledged to any other third person by the Contractor without the prior written consent of IIMB.

c. **Publicity:** Both the Parties shall be entitled to issue or make any press releases or other public announcements relating to this Agreement. However, all press releases or other public announcements relating to this Agreement must be approved in advance and in writing, in each instance, by both the Parties.

d. **Notice:** All notices, including notice of address change, required to be sent hereunder shall be in writing and shall be deemed to have been delivered when mailed by first class mail or reputable courier service return receipt requested to the address stated in the first page of this Agreement. Electronic communications are admissible provided these are sent with delivery confirmation receipt and followed by physical copy mailed as set forth above.

e. **Severability:** If any provision of the Agreement is or becomes invalid or impracticable in whole or part, the validity of the other provisions of this Agreement shall not be affected thereby. The invalid provisions shall be replaced by valid provisions that come closest to the economic intention pursued by the Parties.

f. **Amendments:** This Agreement may only be modified by mutual consent in writing, signed by the authorized representatives of each Party.

g. **Force Majeure:** No Party shall be in default under this Agreement by reason of its failure or delay in the performance of its obligation if such failure or delay is caused by acts of God, Government Laws and Regulations, Strikes/lock-outs at the venue, war, natural calamities or any other cause beyond its control and without its fault or negligence.

   The Party claiming the relief under force majeure shall notify the other Party thereof without undue delay and if the impediment continues for more than three (3) months due to such causes as mentioned above, either party shall be entitled to terminate the Agreement by written notice to the other party without incurring any liability for breach of contract.

h. **Entire Agreement:** The terms and conditions contained in the following documents are deemed to form part of this Agreement, namely, the Tender document including the Notice Inviting Tender, General Conditions, Special Conditions, the Specifications, the Priced Bill of Quantities, the Schedule of rates and prices, and the Drawings mentioned in the Specifications. The letter of Acceptance, Work Order and all the communication between the Parties will also form part of this Agreement.

12. The following tender documents will also form part of the Agreement,

12.1.1.1. Letter of Award Vide NO : ……dated ……..

12.1.1.2. e-bid offer…….. dated ……..

12.1.1.3. Tender, General Conditions of Contract, Special Conditions of Contract, Technical Specifications, Scope of Works & Bill of Quantities

12.1.1.4. Tender drawings

In Witness Whereof the said Parties hereto have hereunto set their hands.

For IIMB	**For Contractor**
Witnesses:	Witnesses:
1.	1.
2.	2.

IMB / CPWD SAFETY CODE

1. Suitable scaffolds should be provided for workmen for all works that cannot safely be done from the ground, or from solid construction except such short period work as can be done safely from ladders. When a ladder is used, an extra mazdoor shall be engaged for holding the ladder and if the ladder is used for carrying materials as well suitable footholds and handhold shall be provided on the ladder and the ladder shall be given an inclination not steeper than ¼ to 1(¼ horizontal and 1 vertical.)

2. Scaffolding of staging more than 3.6 m (12ft.) above the ground or floor, swung or suspended from an overhead support or erected with stationary support shall have a guard rail properly attached or bolted, braced and otherwise secured at least 90 cm. (3ft.) high 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 opening 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.

3. Working platforms, gangways and stairways should be so constructed that they should not sag unduly or unequally, and if the height of the platform or the gangway or the stairway is more than 3.6 m (12ft.) above ground level or floor level, they should be closely boarded, should have adequate width and should be suitably fastened as described in (2) above.

4. Every opening in the floor of a building or in a working platform shall be provided with suitable means to prevent the fall of person or materials by providing suitable fencing or railing whose minimum height shall be 90 cm. (3ft.)

5. Safe means of access shall be provided to all working platforms and other working places. Every ladder shall be securely fixed. No portable single ladder shall be over 9m. (30ft.) in length while the width between side rails in rung ladder shall in no case be less than 29 cm. (11½") for ladder up to and including 3 m. (10 ft.) in length. For longer ladders, this width should be increased at least ¼" for each additional 30 cm. (1 foot) of length. Uniform step spacing of not more than 30 cm shall be kept. Adequate precautions shall be taken to prevent danger from electrical equipment. No materials on any of the sites or work shall be so stacked or placed as to cause danger or inconvenience to any person or the public. The contractor shall provide all necessary fencing and lights to protect the public from accident 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 person for injury sustained owing to neglect of the above precautions and to pay any damages and cost which may be awarded in any such suit; action or proceedings to any such person or which may, with the consent of the contractor, be paid to compensate any claim by any such person.

6. (a) Excavation and Trenching - All trenches 1.2 m. (4ft.) or more in depth, shall at all times be supplied with at least one ladder for each 30 m. (100 ft.) in length or fraction thereof, Ladder shall extend from bottom of the trench to at least 90 cm. (3ft.) above the surface of the ground. The side of the trenches which are 1.5 m. (5ft.) 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. (5ft.) 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.

(b) Safety Measures for digging bore holes: -

(i). If the bore well is successful, it should be safely capped to avoid caving and collapse of the bore well. The failed and the abandoned ones should be completely refilled to avoid caving and collapse.

(ii). During drilling, Sign boards should be erected near the site with the address of the drilling contractor and the Engineer in-charge of the work.

(iii). Suitable fencing should be erected around the well during the drilling and after the installation of the rig on the point of drilling, flags shall be put 50m all-round the point of drilling to avoid entry of people.

(iv). After drilling the bore well, a cement platform (0.50m x 0.50m x 1.20m) 0.60m above ground level and 0.60m below ground level should be constructed around the well casing.

(v). After the completion of the bore well, the contractor should cap the bore well properly by welding steel plate, cover the bore well with the drilled wet soil and fix thorny shrubs over the soil. This should be done even while repairing the pump.

(vi). After the bore well is drilled the entire site should be brought to the ground level.

7. Demolition - Before any demolition work is commenced and also during the progress of the work,

(i) All roads and open areas adjacent to the work site shall either be closed or suitably protected.

(ii) No electric cable or apparatus which is liable to be a source of danger, or a cable or apparatus used by the operator shall remain electrically charged.

(iii) All practical steps shall be taken to prevent danger to persons employed from risk of fire or explosion or flooding. No floor, roof or other part of the building shall be so overloaded with debris or materials as to render it unsafe.

8. All necessary personal safety equipment as considered adequate by the Project Manager should be kept available for the use of the person employed on the site and maintained in a condition suitable for immediate use, and the contractor should take adequate steps to ensure proper use of equipment by those concerned: - The following safety equipment shall invariably be provided.

(i) Workers employed on mixing asphaltic materials, cement and lime mortars shall be provided with protective footwear and protective goggles.

(ii) Those engaged in white washing and mixing or stacking of cement bags or any material which is injurious to the eyes, shall be provided with protective goggles.

(iii) Those engaged in welding works shall be provided with welder’s protective eye shields.

(iv) Stone breaker shall be provided with protective goggles and protective clothing and seated at sufficiently safe intervals.

(v) When workers are employed in sewers and manholes, which are in active use, the contractors shall ensure that the manhole covers are opened and ventilated at least for an hour before the workers are allowed to get into the 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. In addition, the contractor shall ensure that the following safety measure are adhered to:-

(a) Entry for workers into the line shall not be allowed except under supervision of the JE or any other higher Project Manager.

(b) At least 5 to 6 manholes upstream and downstream should be kept open for at least 2 to 3 hours before any man is allowed to enter into the manhole for working inside.

(c) Before entry, presence of Toxic gases should be tested by inserting wet lead acetate paper which changes color in the presence of such gases and gives indication of their presence.

(d) Presence of Oxygen should be verified by lowering a detector lamp into the manhole. In case, no Oxygen is found inside the sewer line, workers should be sent only with Oxygen kit.

(e) Safety belt with rope should be provided to the workers. While working inside the manholes, such rope should be handled by two men standing outside to enable him to be pulled out during emergency.

(f) The area should be barricaded or cordoned off by suitable means to avoid mishaps of any kind. Proper warning signs should be displayed for the safety of the public whenever cleaning works are undertaken during night or day.

(g) No smoking or open flames shall be allowed near the blocked manhole being cleaned.

(h) The malba obtained on account of cleaning of blocked manholes and sewer lines should be immediately removed to avoid accidents on account of slippery nature of the malba.

(i) Workers should not be allowed to work inside the manhole continuously. He should be given rest intermittently. The Project Manager may decide the time up to which a worker may be allowed to work continuously inside the manhole.

(j) Gas masks with Oxygen Cylinder should be kept at site for use in emergency.

(k) Air-blowers should be used for flow of fresh air through the manholes. Whenever called for, portable air blowers are recommended for ventilating the manholes. The Motors for these shall be vapor proof and of totally enclosed type. Non sparking gas engines also could be used but they should be placed at least 2 meters away from the opening and on the leeward side protected from wind so that they will not be a source of friction on any inflammable gas that might be present.

(l) The workers engaged for cleaning the manholes/sewers should be properly trained before allowing to work in the manhole.

(m) The workers shall be provided with Gumboots or non-sparking shoes bump helmets and gloves non sparking tools safety lights and gas masks and portable air blowers (when necessary). They must be supplied with barrier cream for anointing the limbs before working inside the sewer lines.

(n) Workmen descending a manhole shall try each ladder stop or rung carefully before putting his full weight on it to guard against insecure fastening due to corrosion of the rung fixed to manhole well.

(o) If a man has received a physical injury, he should be brought out of the sewer immediately and adequate medical aid should be provided to him.

(p) The extent to which these precautions are to be taken depend on individual situation but the decision of the Project Manager regarding the steps to be taken in this regard in an individual case will be final.

(vi) The Contractor shall not employ men and women below the age of 18 years 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 precaution should be taken: -

(a) No paint containing lead or lead products shall be used except in the form of paste or readymade paint.

(b) 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 is dry rubbed and scrapped.

(c) Overalls shall be supplied by the contractors to the workmen and adequate facilities shall be provided to enable the working painters to wash during and on the cessation of work.

9. An additional clause (viii)(i) of IIMB Safety Code (iv) the Contractor shall not employ women and men below the age of 18 on the work of painting with product containing lead in any form, wherever men above the age of 18 are employed on the work of lead painting, the following principles must be observed for such use:

(i) White lead, sulphate of lead or product containing this pigment, shall not be used in painting operation except in the form of pastes or paint ready for use.

(ii) Measures shall be taken, wherever required in order to prevent danger arising from the application of a paint in the form of spray.

(iii) Measures shall be taken, wherever practicable, to prevent danger arising out of from dust caused by dry rubbing down and scraping.

(iv) Adequate facilities shall be provided to enable working painters to wash during and on cessation of work.

(v) Overall, shall be worn by working painters during the whole of working period.

(vi) Suitable arrangement shall be made to prevent clothing put off during working hours being spoiled by painting materials.

(vii) Cases of lead poisoning and suspected lead poisoning shall be notified and shall be subsequently verified by medical man appointed by competent authority of IIMB.

(viii) IIMB (DA) may require when necessary medical examination of workers.

(ix) Instructions with regard to special hygienic precautions to be taken in the painting trade shall be distributed to working painters.

10. When the work is done near any place where there is risk of drowning, all necessary equipment's 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 obtained during the course of the work.

11. Use of hoisting machines and tackle including their attachments, anchorage and supports shall conform to the following standards or conditions: -

(i) (a) These shall be of good mechanical construction, sound materials and adequate strength and free from patent defects and shall be kept repaired and in good working order.

(b) Every rope used in hoisting or lowering materials or as a means of suspension shall be of durable quality and adequate strength, and free from patent defects.

(ii) Every crane driver or hoisting appliance operator shall be properly qualified and no person under the age of 21 years should be in charge of any hoisting machine including any scaffolding winch or give signals to operator.

(iii) In case of every hoisting machine and of every chain ring hook, shackle swivel 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 condition 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.

(iv) In case of departmental machines, the safe working load shall be notified by the Electrical Engineer- in-Charge. As regards contractor's machines the contractors shall notify the safe working load of the machine to the Project Manager whenever he brings any machinery to site of work and get it verified by the Electrical Engineer concerned.

12. 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 the risk of accidental descent of the load. Adequate precautions should be taken to reduce to the minimum the risk of any part of a suspended load becoming accidentally displaced. When workers are employed on electrical installations which are already energized, insulating mats, wearing apparel, such as gloves, sleeves and boots as may be necessary should be provided. The worker should not wear any rings, watches and carry keys or other materials which are good conductors of electricity.

13. All scaffolds, ladders and other safety devices mentioned or described herein shall be maintained in safe condition and no scaffold, 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.

14. 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.

15. 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 Labor Project Manager or Project Manager of the department or their representatives.

16. Notwithstanding the above clauses from (1) to (15), 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

IIMB Contractor's Labor Regulations

1. SHORT TITLE

These regulations may be called the C.P.W.D./PWD (DA) Contractors Labor Regulations.

2. DEFINITIONS

i) Workman means any person employed by IIMB (DA) or its contractor directly or indirectly through a subcontractor with or without the knowledge of the Central Public Works Department/PWD (DA) to do any skilled, semiskilled, or unskilled manual, supervisory, technical, or clerical work for hire or reward, whether the terms of employment are expressed or implied but does not include any person: -

a) Who is employed mainly in a managerial or administrative capacity: or

b) Who, being employed in a supervisory capacity draws wages exceeding five hundred rupees per mensem or exercises either by the nature of the duties attached to the office or by reason of powers vested in him, functions mainly of managerial nature: or

c) Who is an out worker, that is to say, person to whom any article or materials are given out by or on behalf of the principal employers to be made up cleaned, washed, altered, ornamental finished, repaired adopted or otherwise processed for sale for the purpose of the trade or business of the principal employers and the process is to be carried out either in the home of the out worker or in some other premises, not being premises under the control and management of the principal employer.

No person below the age of 14 years shall be employed to act as a workman.

ii) Fair Wages means wages whether for time or piece work fixed and notified under the provisions of the Minimum Wages Act from time to time.

iii) Contractors shall include every person who undertakes to produce a given result other than a mere supply of goods or articles of manufacture through contract labor or who supplies contract labor for any work and includes a subcontractor.

iv) Wages shall have the same meaning as defined in the Payment of Wages Act.

3. i) Normally working hours of an adult employee should not exceed 9 hours a day. The working day shall be so arranged that inclusive of interval for rest, if any, it shall not spread over more than 12 hours on any day.

ii) When an adult worker is made to work for more than 9 hours on any day or for more than 48 hours in any week, he shall be paid overtime for the extra hours put in by him at double the ordinary rate of wages.

iii) a) Every worker shall be given a weekly holiday normally on a Sunday, in accordance with the provisions of the Minimum Wages (Central) Rules 1960 as amended from time to time irrespective of whether such worker is governed by the Minimum Wages Act or not.

b) Where the minimum wages prescribed by the IIMB under the Minimum Wages Act are not inclusive of the wages for the weekly day of rest, the worker shall be entitled to rest day wages at the rate applicable to the next preceding day, provided he has worked under the same contractor for a continuous period of not less than 6 days.

c) Where a contractor is permitted by the Project Manager to allow a worker to work on a normal weekly holiday, he shall grant a substituted holiday to him for the whole day on one of the five days immediately before or after the normal weekly holiday and pay wages to such worker for the work performed on the normal weekly holiday at overtime rate.

4. DISPLAY OF NOTICE REGARDING WAGES ETC.

The contractor shall before he commences his work on contract, display and correctly maintain and continue to display and correctly maintain in a clear and legible condition in conspicuous places on the work, notices in English and in the local Indian languages spoken by the majority of the workers giving the minimum rates of wages fixed

under Minimum Wages Act, the actual wages being paid, the hours of work for which such wage are earned, wages periods, dates of payments of wages and other relevant information as per Appendix 'III'.

5. PAYMENT OF WAGES

i) The contractor shall fix wage periods in respect of which wages shall be payable.

ii) No wage period shall exceed one month.

iii) The wages of every person employed as contract labor in an establishment or by a contractor where less than one thousand such persons are employed shall be paid before the expiry of seventh day and in other cases before the expiry of tenth day after the last day of the wage period in respect of which the wages are payable.

iv) Where the employment of any worker is terminated by or on behalf of the contractor the wages earned by him shall be paid before the expiry of the second working day from the date on which his employment is terminated.

v) All payment of wages shall be made on a working day at the work premises and during the working time and on a date notified in advance and in case the work is completed before the expiry of the wage period, final payment shall be made within 48 hours of the last working day.

vi) Wages due to every worker shall be paid to him direct or to other person authorized by him in this behalf.

vii) All wages shall be paid in current coin or currency or in both.

viii) Wages shall be paid without any deductions of any kind except those specified by the Central IIMB by general or special order in this behalf or permissible under the Payment of Wages Act 1956.

ix) A notice showing the wages period and the place and time of disbursement of wages shall be displayed at the place of work and a copy sent by the contractor to the Project Manager under acknowledgment.

x) It shall be the duty of the contractor to ensure the disbursement of wages in the presence of the Junior Engineer or any other authorized representative of the Project Manager who will be required to be present at the place and time of disbursement of wages by the contractor to workmen.

xi) The contractor shall obtain from the Junior Engineer or any other authorized representative of the Project Manager as the case may be, a certificate under his signature at the end of the entries in the "Register of Wages" or the "Wage-cum-Muster Roll" as the case may be in the following form: -

"Certified that the amount shown in column No has been paid to the workman

Concerned in my presence on ..... at "

6. FINES AND DEDUCTIONS WHICH MAY BE MADE FROM WAGES

(i) The wages of a worker shall be paid to him without any deduction of any kind except the following: -

(a) Fines

(b) Deductions for absence from duty i.e., from the place or the places whereby the terms of his employment he is required to work. The amount of deduction shall be in proportion to

The period he was absent.

(c) Deduction for damage to or loss of goods expressly entrusted to the employed person for custody, or for loss of money or any other deduction which he is required to account, where such damage or loss is directly attributable to his neglect or default.

(d) Deduction for recovery of advances or for adjustment of overpayment of wages, advances granted shall be entered in a register.

(e) Any other deduction which the Central IIMB may from time to time allow.

(i) No fines should be imposed on any worker save in respect of such acts and omissions on his part as have been approved of by the Chief Labor Commissioner.

Note: - An approved list of Acts and Omissions for which fines can be imposed is enclosed at Appendix-X

(ii) No fine shall be imposed on a worker and no deduction for damage or loss shall be made from his wages until the worker has been given an opportunity of showing cause against such fines or deductions.

(iii) The total amount of fine which may be imposed in any one wage period on a worker shall not exceed an amount equal to three paise in a rupee of the total wages, payable to him in respect of that wage period.

(iv) No fine imposed on any worker shall be recovered from him by instalment, or after the expiry of sixty days from the date on which it was imposed.

(v) Every fine shall be deemed to have been imposed on the day of the act or omission in respect of which it was imposed.

7. LABOUR RECORDS

(i) The contractor shall maintain a Register of persons employed on work on contract in Form XIII of the CL (R&A) Central Rules 1971 (Appendix IV)

(ii) The contractor shall maintain a Muster Roll register in respect of all workmen employed by him on the work under Contract in Form XVI of the CL (R&A) Rules 1971 (Appendix V).

(iii) The contractor shall maintain a Wage Register in respect of all workmen employed by him on the work under contract in Form XVII of the CL (R&A) Rules 1971 (Appendix VI).

(iv) Register of accident - The contractor shall maintain a register of accidents in such form as may be convenient at the workplace but the same shall include the following particulars:

a) Full particulars of the laborers who met with accident.

b) Rate of Wages.

c) Sex

d) Age

e) Nature of accident and cause of accident.

f) Time and date of accident.

g) Date and time when admitted in Hospital,

h) Date of discharge from the Hospital.

i) Period of treatment and result of treatment.

j) Percentage of loss of earning capacity and disability as assessed by Medical Project Manager.

k) Claim required to be paid under Workmen’s Compensation Act.

l) Date of payment of compensation.

m) Amount paid with details of the person to whom the same was paid.

n) Authority by whom the compensation was assessed.

o) Remarks

v) The contractor shall maintain a Register of Fines in the Form XII of the CL (R&A) Rules 1971 (Appendix-XI)

The contractor shall display in a good condition and in a conspicuous place of work the approved list of acts and omissions for which fines can be imposed (Appendix-X)

vi) The contractor shall maintain a Register of deductions for damage or loss in Form XX of the CL (R&A) Rules 1971 (Appendix-XII)

vii) The contractor shall maintain a Register of Advances in Form XXIII of the CL (R&A) Rules 1971 (Appendix-XIII)

viii) The contractor shall maintain a Register of Overtime in Form XXIII of the CL (R&A) Rules 1971 (Appendix-XIV)

8. ATTENDANCE CARD-CUM-WAGE SLIP

i) The contractor shall issue an Attendance card-cum-wage slip to each workman employed by him in the specimen form at (Appendix-VII)

ii) The card shall be valid for each wage period.

iii) The contractor shall mark the attendance of each workman on the card twice each day, once at the commencement of the day and again after the rest interval, before he actually starts work.

iv) The card shall remain in possession of the worker during the wage period under reference.

v) The contractor shall complete the wage slip portion on the reverse of the card at least a day prior to the disbursement of wages in respect of the wage period under reference.

vi) The contractor shall obtain the signature or thumb impression of the worker on the wage slip at the time of disbursement of wages and retain the card with himself.

9. EMPLOYMENT CARD

The contractor shall issue an Employment Card in Form XIV of the CL (R&A) Central Rules 1971 to each worker within three days of the employment of the worker (Appendix-VIII).

10. SERVICE CERTIFICATE

On termination of employment for any reason whatsoever the contractor shall issue to the workman whose services have been terminated, a Service certificate in Form XV of the CL (R&A) Central Rules 1971 (Appendix-IX)

11. PRESERVATION OF LABOUR RECORDS

All records required to be maintained under Regulations Nos. 6 & 7 shall be preserved in original for a period of three years from the date of last entries made in them and shall be made available for inspection by the Project Manager or Labor Project Manager or any other Project Managers authorized by the Ministry of Urban Development in this behalf.

12. POWER OF LABOUR Project Manager TO MAKE INVESTIGATIONS OR ENQUIRY

The Labor Project Manager or any person authorized by Central IIMB on their behalf shall have power to make enquires with a view to ascertaining and enforcing due and proper observance of Fair Wage Clauses and the Provisions of these Regulations. He shall investigate into any complaint regarding the default made by the contractor or subcontractor in regard to such provision.

13. REPORT OF LABOUR OFFICER

The Labor officer or other persons authorized as aforesaid shall submit a report of result of his investigation or enquiry to the Project Manager concerned indicating the extent, if any, to which the default has been committed with a note that necessary deductions from the contractor's bill be made and the wages and other dues be paid to the laborers concerned. In case an appeal is made by the contractor under Clause 13 of these regulations, actual payment to laborers will be made by the Project Manager after the Director, IIMB has given his decision on such appeal.

i) The Project Manager shall arrange payments to the labor concerned within 45 days from the receipt of the report form the Labor officer or the Director, IIMB as the case may be.

14. APPEAL AGAINST THE DECISION OF LABOUR OFFICER

Any person aggrieved by the decision and recommendations of the Labor Officer or other person so authorized may appeal against such decision to the Director, IIMB concerned within 30 days from the date of decision, forwarding simultaneously a copy of his appeal to the Project Manager concerned but subject to such appeal, the decision of the Project Manager shall be final and binding upon the contractor.

15. PROHIBITION REGARDING REPRESENTATION THROUGH LAWYER

i) A workman shall be entitled to be represented in any investigation or enquiry under these regulations by: -

a) A Project Manager of a registered trade union of which he is a member.

b) A Project Manager of a federation of trade unions to which the trade union referred to in clause (a) is affiliated.

c) Where the employer is not a member of any registered trade union, by a Project Manager of a registered trade union, connected with the industry in which the worker is employed or by any other workman employed in the industry in which the worker is employed.

ii) An employer shall be entitled to be represented in any investigation or enquiry under these regulations by: -

a) A Project Manager of an association of employers of which he is a member.

b) A Project Manager of a federation of associations of employers to which association referred to in clause (a) is affiliated.

c) Where the employers are not a member of any association of employers, by a Project Manager of association of employer connected with the industry in which the employer is engaged or by any other employer, engaged in the industry in which the employer is engaged.

(iii) No party shall be entitled to be represented by a legal practitioner in any investigation or enquiry under these regulations.

16. INSPECTION OF BOOKS AND SLIPS

The contractor shall allow inspection of all the prescribed labor records to any of his workers or to his agent at a convenient time and place after due notice is received or to the Labor Project Manager or any other person, authorized by the Central IIMB on his behalf.

17. SUBMISSIONS OF RETURNS

The contractor shall submit periodical returns as may be specified from time to time.

18. AMENDMENTS

The IIMB may from time to time add to or amend the regulations and on any question as to the application/Interpretation or effect of those regulations the decision of the Director, IIMB shall be final.

Appendix 'I'

REGISTER OF MATERNITY BENEFITS (Clause 19 F)

Name and address of the contractor.....…

Name and location of the work.....…

Name of the employee	Father's/ husband's name	Nature of employment	Period of actual employment	Date on which notice of confinement given
1	2	3	4	5

Date on which maternity leave commenced and ended

Date of delivery/ miscarriage	In case of delivery		In case of miscarriage	
	commenced	Ended	Commenced	Ended
6	7	8	9	10

Leave pay paid to the employee

In case of delivery		In case of miscarriage		Remarks
Rate of leave pay	Amount paid	Rate of leave pay	Amount paid	
11	12	13	14	15

APPENDIX 'II'

SPECIMEN FORM OF THE REGISTER, REGARDING MATERNITY BENEFIT ADMISSIBLE TO THE CONTRACTOR'S LABOUR IN CENTRAL PUBLIC WORKS DEPARTMENT WORKS.

Name and address of the contractor.....

Name and location of the work.....…

1- Name of the woman and her husband's name.

2- Designation

3- Date of appointment.

4- Date with months and years in which she is employed.

5- Date of discharge/dismissal, if any.

6- Date of production of certificates in respect of pregnancy.

7- Date on which the woman informs about the expected delivery.

8- Date of delivery/miscarriage/death

9- Date of production of certificate in respect of delivery/miscarriage.

10- Date with the amount of maternity/death benefit paid in advance of expected delivery.

11- Date with amount of subsequent payment of maternity benefit.

12- Name of the person nominated by the woman to receive the payment of the maternity benefit after her death.

13- If the woman dies, the date of her death, the name of the person to whom maternity benefit amount was paid, the month thereof and the date of payment.

14- Signature of the contractor authenticating entries in the register.

Remarks column for the use of Inspecting Project Manager.

Appendix 'III'

Labor Board

Name of work…….

Name of Contractor…….

Name and address of Division……

Name of Labor Officer / Project Manager……

Address of Labor Officer / Project Manager……

Name of Labor Enforcement Officer / Project Manager……

Address of Labor Enforcement Officer / Project Manager……

SI. No.	Category	Minimum wage fixed	Actual wage paid	Number present	Remarks

Weekly holiday…….

Wage period…….

Date of payment of wages…….

Rest interval…….

Form-XIII (See Rule 75)

Register of Workmen Employed by Contractor…….

Name and address of contractor……..

Name and address of establishment under which contract is carried on…….

Nature and location of work……..

Name and address of Principal Employer……..

SI. No	Name and Surname of workman	Age and Sex	Father's /Husband's name	Nature of employment/ designation	Permanent home address of the workman (Village and Tehsil, Taluk and District)	Locl address	Date of commence- ment of employment	Signature or thumb impression of the workman	Date of termination of employment	Reasons for terminations	Remarks
1	2	3	4	5	6	7	8	9	10	11	12

Form-XVI (See Rule 78(2)(a))
Muster Roll

Name and address of contractor……..

Name and address of establishment under which contract is carried on……..

Nature and location of work……

Name and address of Principal Employer…… ……..For the Month of fortnight……

Sl. No	Name of Workman	Sex	Father's/Husband's name	Dates					Remarks
1	2	3	4	5					6
				1	2	3	4	5	

Form-XVII (See Rule 78(2)(a))

Register of wages

Name and address of contractor……

Name and address of establishment under which contract is carried on……

Nature and location of work……..

Name and address of Principal Employer.....wages Period: Monthly/Fortnight

Sl. No.	Name of work man	Serial No. in the reg-ister of workman	Design ation/ nature of work done	No. of days worke d	Units of work done	Daily rate of wages/ piece rate	Amount of wages earned					Deduct ions if any (indicat e nature)	Net amoun t paid	Signat ure or thumb impres sion of the work-man	Initial of contrac tor or his represe - ntative
							Basic wage s	Dearnes s allowanc es	Overt ime	Other cash payme nts (Indica te nature)	Tot al				
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

Wage Card No.....

Wage Card- Appendix VII

Name and address of contractor……. Date of Issue…….

Name and location of work……... Designation……

Name of workman…… Month/Fortnight

Rate of Wages……...

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31

Morning Rate

Evening Amount

Initial

Received from ……the sum of

Rs……. on account of my wages

Wage Card is valid for one month from the date of issue Signature.

Appendix 'VII'

Form-XIX

[See rule 78 (2)(b)]

Wages Slip

Name and address of contractor.....…

Name and Father's/Husband's name of workman.....…

Nature and location of work.....…

For the Week/Fortnight/Month ending.....…

1- No. of days worked.....……..

2- No. of units worked in case of piece rate workers.....……..

3- Rate of daily wages/piece rate .....……

4- Amount of overtime wages.....

5- Gross wages payable.....……..

6- Deduction, if any.....

7- Net amount of wages paid.....

Initials of the contractor or his representative

Appendix 'VII'

Form-XIV

[See rule 76]

Employment Card

Name and address of contractor----------

Name and address of establishment under which contract is carried on----------

Name of work and location of work----------

Name and address of Principal Employer----------

Name of the workman----------

SI. No. in the register of workman employed----------

Nature of employment/designation----------

Wage rate (with particulars of unit in case of piece work) ----------

Wage period----------

Tenure of employment----------

Remarks----------

Signature of contractor

Form-XV (See Rule 77)

Service Certificate

Name and address of contractor……

Nature and location of work……

Name and address of workman…….

Age or date of birth……..

Identification marks……..

Name and address of establishment in under which contract is carried on

Name and address of Principal Employer

Sl. No	Total Period for which employed		Nature of Work Done	Rate of wages (with particulars of unit in case of piece work)	Remarks
	From	To			
1	2	3	4	5	6

Signature

Appendix 'X'

LIST OF ACTS AND OMISSONS FOR WHICH FINES CAN BE IMPOSED

In accordance with rule 7(v) of the IIMB Contractor's Labour Regulations to be displayed prominently at the site of work both in English and local Language.

1. Willful insubordination or disobedience, whether alone or in combination with other.
2. Theft fraud or dishonesty in connection with the contractors beside a business or property of CPWD.
3. Taking or giving bribes or any illegal gratifications
4. Habitual late attendance.
5. Drunkenness lighting, riotous or disorderly or indifferent behaviour
6. Habitual negligence.
7. Smoking near or around the area where combustible or other materials are locked
8. Habitual indiscipline.
9. Causing damage to work in the progress or to property of the CPWD or of the contractor.
10. Sleeping on duty.
11. Malingering or slowing down work.
12. Giving of false information regarding name, age father's name, etc.
13. Habitual loss of wage cards supplied by the employers.
14. Unauthorized use of employer's property of manufacturing or making of unauthorized particles at the workplace.
15. Bad workmanship in construction and maintenance by skilled workers which is not approved by the Department and for which the contractors are compelled to undertake rectifications.
16. Making false complaints and/or misleading statements.
17. Engaging on trade within the premises of the establishments.
18. Any unauthorized divulgence of business affairs of the employees.
19. Collection or canvassing for the collection of any money within the premises of an establishment unless authorized by the employer.
20. Holding meeting inside the premises without previous sanction of the employers.
21. Threatening or intimidating any workman or employer during the working hours within the premises.

Appendix 'XI'

Form-XII (See Rule 78(2) (d))

Register of Fines

Name and address of contractor……

Name and address of establishment in under which contract is carried on……

Nature and location of work……

Name and address of Principal Employer……

Sl. No	Name of workman	Father's/ Husband's name	Designation/ nature of employment	Act/Omission for which fine imposed	Date of Offence	Whether workman showed cause against fine	Name of person in whose presence employee's explanation was heard	Wage period and wages payable	Amount of fine imposed	Date on which fine realized	Remarks
1	2	3	4	5	6	7	8	9	10	11	12

Appendix 'XII'

Form-XX (See Rule 78(2) (d))

Register of Deduction for Damage or Loss

Name and address of contractor……

Name and address of establishment in under which contract is carried on……

Nature and location of work……

Name and address of Principal Employer……

Sl. N.	Name of Workman	Father's/Husband name	Designation/ nature of employment	Particulars of damage or loss	Date of damage or loss	Whether workman showed cause against deduction	name of person in whose presence employee's explanation was heard	Amount of deduction imposed	installments	Date of recovery		Remarking
										First install-ment	Last install-ment	
1	2	3	4	5	6	7	8	9	10	11	12	13

Appendix ‘XIII’

Form-XXII (See Rule 78(2) (d))

Register of Advances

Name and address of contractor…….

Name and address of establishment in under which contract is carried on……

Nature and location of work…….

Name and address of Principal Employer……

Sl. No.	Name of workman	Father’s/ Husband name	Designation/ nature of employment	Wage Period and wages payable	Date and amount of advance given	Purpose(s) for which advance made	Number of installments by which advance to be repaid	Date and amount of each installm- ent repaid	Date and which last installment was repaid	Remarks
1	2	3	4	5	6	7	8	9	10	11

Appendix 'XIV'

Form-XXIII (See Rule 78(2) (e))

Register of Overtime

Name and address of contractor……

Name and address of establishment in under which contract is carried on……..

Nature and location of work……

Name and address of Principal Employer……

Sl. No.	Name of Workman	Father's/ Husband's name	Sex	Designation/ nature of employment	Date on which Overtime worked	Total overtime worked or production in case of piece rated	Normal rate of wages	Overtime rate of wages	Overtime earning	Rate on which overtime paid	Remarks
1	2	3	4	5	6	7	8	9	10	11	12

Appendix - XV (FORM 31)

INDENTURE FOR SECURED ADVANCES

(Referred to in paragraphs 10.2.20 and 10.2.22 of CPW A Code)

(For use in cases in which the contract is for finished work and the contractor has entered into an agreement for the execution of a certain specified quantity of work in a given time)

THIS INDENTURE made the…… day of ……20……. BETWEEN …… (hereinafter called the Contractor which expression shall where the context so admits or implies be deemed to include his executors administrators and assigns) of the one part and the DIRECTOR OF IIMB (hereinafter called the President which expression shall where the context so admits or implies be deemed to include his successors in office and assigns) of the other part.

WHEREAS by an agreement dated… ..... (Hereinafter called the said agreement) the Contractor has agreed AND WHEREAS the Contractor has applied to the President that he may be allowed advances on the security of materials absolutely belonging to him and brought by him to the site of the works the subject of the said agreement for use in the construction of such of the works as he has undertaken to execute at rates fixed for the finished work (inclusive of the cost of materials and labour and other charges) AND WHEREAS the President has agreed to advance to the Contractor the sum of Rupees ..... on the security of materials the quantities and other particulars of which are detailed in Accounts of Secured Advances attached to the Running Account Bill for the said works signed by the Contractor on..... and the President has reserved to himself the option of making any further advance or advances on the security of other materials brought by the Contractor to the site of the said works. Now THIS INDENTURE WITNESSETH that in pursuance of the said agreement and in consideration of the sum of Rupees ..... on or before the execution of these presents paid to the Contractor by the President (the receipt whereof the Contractor doth hereby acknowledge) and of such further advances (if any) as may be made to him as aforesaid the Contractor doth hereby covenant and agree with the President and declare as follows: -

(1) That the said sum of Rupees ..... so advanced by the President to the Contractor as aforesaid and all or any further sum or sums advanced as aforesaid shall be employed by the Contractor in or towards expediting the execution of the said works and for no other purpose whatsoever.

(2) That the materials detailed in the said Account of Secured Advances which have been offered to and accepted by the President as security are absolutely the Contractor's own property and free from encumbrances of any kind and the contractor will not make any application for or receive a further advance on the security of materials which are not absolutely his own property and free from encumbrances of any kind and the Contractor indemnifies the President against all claims to any materials in respect of which an advance has been made to him as aforesaid.

(3) That the materials detailed in the said Account of Secured Advances and all other materials on the security of which any further advance or advances may hereafter be made as aforesaid (hereinafter called the said materials) shall be used by the Contractor solely in the execution of the said works in accordance with the directions of the Divisional Officer Division (hereinafter called the Divisional Officer) and in the term of the said agreement.

(4) That the Contractor shall make at his own cost all necessary and adequate arrangements for the proper watch, safe custody and protection against all risks of the said materials and that until used in construction as aforesaid the said materials shall remain at the site of the said works in the Contractor's custody and on his own responsibility and shall at all times be open to inspection by the Divisional Officer or any officer authorised by

him. In the event of the said materials or any part thereof being stolen, destroyed or damaged or becoming deteriorated in a greater degree than is due to reasonable use and wear thereof the Contractor will forthwith replace the same with other materials of like quality or repair and make good the same as required by the Divisional Officer.

(5) That the said materials shall not on any account be removed from the site of the said works except with the written permission of the Divisional Officer or an officer authorised by him on that behalf.

(6) That the advances shall be repayable in full when or before the Contractor receives payment from the President of the price payable to him for the said works under the terms and provisions of the said agreement. Provided that if any intermediate payments are made to the Contractor on account of work done than on the occasion of each such payment the President will be at liberty to make a recovery from the Contractor's bill for such payment by deducting there from the value of the said materials then actually used in the construction and in respect of which recovery has not been made previously, the value for this purpose being determined in respect of each description of materials at the rates at which the amounts of the advances made under these presents were calculated.

(7) That if the Contractor shall at any time make any default in the performance or observance in any respect of any of the terms and provisions of the said agreement or of these presents the total amount of the advance or advances that may still be owing to the President shall immediately on the happening of such default be repayable by the Contractor to the President together with interest thereon at twelve per cent per annum from the date or respective dates of such advance or advances to the date of repayment and with all costs charges, damages and expenses incurred by the President in or for the recovery thereof or the enforcement of this security or otherwise by reason of the default of the Contractor and the Contractor hereby covenants and agrees with the President to repay and pay the same respectively to him accordingly.

(8) That the Contractor hereby charges all the said materials with the repayment to the President of the said sum of Rupees ..... and any further sum or sums advanced as aforesaid and all costs charges, damages and expenses payable under these presents PROVIDED ALWAYS and it is hereby agreed and declared that notwithstanding anything in the said agreement and without prejudice to the powers contained therein if and whenever the covenant for payment and repayment herein before contained shall become enforceable and the money owing shall not be paid in accordance therewith the President may at any time thereafter adopt all or any of the following courses as he may deem best :-

(a) Size and utilize the said materials or any part thereof in the completion of the said works on behalf of the Contractor in accordance with the provisions in that behalf contained in the said agreement debiting the Contractor with the actual cost of effecting such completion and the amount due in respect of advances under these presents and crediting the Contractor with the value of work done as if he had carried it out in accordance with the said agreement and at the rates thereby provided. If the balance is against the Contractor, he is to pay same to the President on demand.

(b) Remove and sell by public auction the seized materials or any part thereof and out of the moneys arising from the sale retain all the sums aforesaid repayable or payable to the President under these presents and pay over the surplus (if any) to the Contractor.

(c) Deduct all or any part of the moneys owing out of the security deposit or any sum due to the Contractor under the said agreement.

(9) That except in the event of such default on the part of the Contractor as aforesaid interest on the said advance shall not be payable.

(10) That in the event of any conflict between the provisions of these presents and the said agreement the provisions of these presents shall prevail and in the event of any dispute or difference arising over the construction or effect of these presents the settlement of which has not been herein before expressly provided for the same shall be finally resolved as per provisions of clause 25 of the contract.

In witness whereof the said ……and ..... by the order and under the direction of the President have hereunto set their respective hands the day and year first above written.

Signed, sealed and delivered by…….. the said contractor in the presence of .....

.....

Signature ……

Witness Name ……..

Address …….

Signed by……..

by the order and direction of the President in the presence of

Signature ……

Witness Name ……..

Address …….

APPENDIX - XVI
(Refer Clause 5)
FORM OF APPLICATION BY THE CONTRACTOR FOR SEEKING RESCHEDULING OF MILESTONE/EXTENSION OF TIME

1. Name of contractor
2. Name of work as given in the agreement
3. Agreement no
4. Estimated amount put tender CON 297 Page 27
5. Date of commencement of work as per agreement
6. Period allowed for completion of work as per agreement
7. Date of completion stipulated in agreement
8. Period for which extension of time if has been given by authority in Schedule 'F' previously

letter no. and date	Extension granted	
	Months	Days
(a) 1st extension.....		
(b) 2nd extension		
(c) 3rd extension		
(d) 4th extension		
(e) Total extension previously given		

9. Reasons for which extension have been previously given (copies of the previous applications should be attached)
10. Period for which extension if applied for
11. Hindrances on account of which extension is applied for with dates on which hindrances occurred and the period for which these are likely to last (for causes under clause 5.2/ and 5.3).

Submitted to the Authority indicated in Schedule F With copy to the Engineer-in-charge and Sub Divisional Officer

Signature of Contractor

Dated .....

APPENDIX - XVII
Notice for appointment of Arbitrator [Refer Clause 25]

To

.....

Dear Sir,
In terms of clause 25 of the agreement, particulars of which are given below, I/we hereby give notice to you to appoint an arbitrator for settlement of disputes mentioned below:

1. Name of applicant
2. Whether applicant is Individual/Prop. Firm/Partnership Firm/Ltd. Co.
3. Full address of the applicant
4. Name of the work and contract number in which arbitration sought
5. Name of the Division which entered into contract
6. Contract amount in the work
7. Date of contract
8. Date of initiation of work
9. Stipulated date of completion of work
10. Actual date of completion of work (if completed)
11. Total number of claims made
12. Total amount claimed
13. Date of intimation of final bill (if work is completed)
14. Date of payment of final bill (if work is completed)
15. Amount of final bill (if work is completed)
16. Date of appeal to you
17. Date of receipt of your decision.

Specimen signatures of the applicant (only the person/authority who signed the contract should sign)

I/We certify that the information given above is true to the best of my/our knowledge. I/We enclose following documents.

1. We have exhausted provision of DRC as per clause 25 of this agreement.
2. Statement of claims with amount of claims. 3.
4.
5.

Yours faithfully,

(Signatures)
Copy in duplicate to:
1.

Form of Earnest Money Deposit Bank Guarantee Bond

WHEREAS contractor .....(Name of contractor) (hereinafter called "the contractor") has submitted his tender dated ..... (date) for the construction of..... (name of work) (hereinafter called "the Tender") KNOW ALL PEOPLE by these presents that we .....(name of bank) having our registered office at . . . . . (Hereinafter called "the Bank") are bound unto
..... (Name and division of Executive Engineer) (hereinafter called "the Engineer-in-Charge") in the sum of Rs. ..... (Rs. in words.....) for which payment well and truly to be made to the said Engineer-in-Charge the Bank binds itself, his successors and assigns by these presents. SEALED with the Common Seal of the said Bank this ..... day of ..... 20. ..... THE CONDITIONS
of this obligation are:

(1) If after tender opening the Contractor withdraws, his tender during the period of validity of tender (including extended validity of tender) specified in the Form of Tender.

(2) If the contractor having been notified of the acceptance of his tender by the Engineer-in-Charge:

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

OR

(b) fails or refuses to furnish the Performance Guarantee, in accordance with the provisions of tender document and Instructions to contractor,

We undertake to pay to the Engineer-in-Charge either up to the above amount or part thereof upon receipt of his first written demand, without the Engineer-in-Charge having to substantiates his demand, provided that in his demand the Engineer-in-Charge will note that the amount claimed by his is due to him owing to the occurrence of one or any of the above conditions, specifying the occurred condition or conditions.

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

DATE ..... SIGNATURE OF THE BANK

WITNESS ..... SEAL

(SIGNATURE, NAME AND ADDRESS)

*Date to be worked out on the basis of validity period of 6 months from last date of receipt of tender

Form of Performance Security (Guarantee) Bank Guarantee Bond-Format - I

In consideration of the Director of IIMB (hereinafter called "The Government") having offered to accept the terms and conditions of the proposed agreement between…….and ..... (hereinafter called "the said Contractor(s)") for the work…..... (Hereinafter called "the said agreement") having agreed to production of an irrevocable Bank Guarantee for Rs. ……..(Rupees …… only) as a security/guarantee from the contractor(s) for compliance of his obligations in accordance with the terms and conditions in the said agreement.

1. We,.....(hereinafter referred to as "the Bank") hereby undertake to pay to the Government an amount not exceeding Rs. …….. (Rupees… ..... Only) on demand by the Government.

2. We,.....(indicate the name of the Bank) do hereby undertake to pay the amounts due and payable under this guarantee without any demure, merely on a demand from the Government stating that the amount claimed as required to meet the recoveries due or likely to be due from the said contractor(s). Any such demand made on the bank shall be conclusive as regards the amount due and payable by the bank under this Guarantee. However, our liability under this guarantee shall be restricted to an amount not exceeding Rs. …….. (Rupees ..... only)

3. We, the said bank further undertakes to pay the Government any money so demanded notwithstanding any dispute or disputes raised by the contractor(s) in any suit or proceeding pending before any court or Tribunal relating thereto, our liability under this present being absolute and unequivocal. The payment so made by us under this bond shall be a valid discharge of our liability for payment thereunder and the Contractor(s) shall have no claim against us for making such payment.

4. We, ...(indicate the name of the Bank) further agree that the guarantee herein contained shall remain in full force and effect during the period that would be taken for the performance of the said agreement and that it shall continue to be enforceable till all the dues of the Government under or by virtue of the said agreement have been fully paid and its claims satisfied or discharged or till Engineer-in- Charge on behalf of the Government certified that the terms and conditions of the said agreement have been fully and properly carried out by the said Contractor(s) and accordingly discharges this guarantee.

5. We,.....(indicate the name of the Bank) further agree with the Government that the Government shall have the fullest liberty without our consent and without affecting in any manner our obligation hereunder to vary any of the terms and conditions of the said agreement or to extend time of performance by the said Contractor(s) from time to time or to postpone for any time or from time to time any of the powers exercisable by the Government against the said contractor(s) and to forbear or enforce any of the terms and conditions relating to the said agreement and we shall not be relieved from our liability by reason of any such variation, or extension being granted to the said Contractor(s) or for any forbearance, act of omission on the part of the Government or any indulgence by the Government to the said Contractor(s) or by any such matter or thing whatsoever which under the law relating to sureties would, but for this provision, have effect of so relieving us.

6. This guarantee will not be discharged due to the change in the constitution of the Bank or the Contractor(s).

7. We,..... (indicate the name of the Bank) lastly undertake not to revoke this guarantee except with the previous consent of the Government in writing.

8. This guarantee shall be valid up to..... unless extended on demand by the Government. Notwithstanding anything mentioned above, our liability against this guarantee is restricted to Rs. …… (Rupees .....) and unless a claim in writing is lodged with us within six months of the date of expiry or the extended date of expiry of this guarantee all our liabilities under this guarantee shall stand discharged. Dated the ……...day of ……for… ..... (Indicate the name of the Bank)

Form of Performance Security (Guarantee) Bank Guarantee Bond- Format -II

In consideration of the Director of IIMB (hereinafter called "The Government") having offered to accept the terms and conditions of the proposed agreement between…….and ..... (hereinafter called "the said Contractor(s)") for the work…..... (Hereinafter called "the said agreement") having agreed to production of an irrevocable Bank Guarantee for Rs. ……..(Rupees …… only) as a security/guarantee from the contractor(s) for compliance of his obligations in accordance with the terms and conditions in the said agreement.

1. We,.....(hereinafter referred to as "the Bank") hereby undertake to pay to the Government an amount not exceeding Rs. …….. (Rupees… ..... Only) on demand by the Government.
2. We,.....(indicate the name of the Bank) do hereby undertake to pay the amounts due and payable under this guarantee without any demure, merely on a demand from the Government stating that the amount claimed as required to meet the recoveries due or likely to be due from the said contractor(s). Any such demand made on the bank shall be conclusive as regards the amount due and payable by the bank under this Guarantee. However, our liability under this guarantee shall be restricted to an amount not exceeding Rs. ……. (Rupees ..... only)
3. We, the said bank further undertakes to pay the Government any money so demanded notwithstanding any dispute or disputes raised by the contractor(s) in any suit or proceeding pending before any court or Tribunal relating thereto, our liability under this present being absolute and unequivocal. The payment so made by us under this bond shall be a valid discharge of our liability for payment thereunder and the Contractor(s) shall have no claim against us for making such payment.
4. We, ...(indicate the name of the Bank) further agree that the guarantee herein contained shall remain in full force and effect during the period that would be taken for the performance of the said agreement and that it shall continue to be enforceable till all the dues of the Government under or by virtue of the said agreement have been fully paid and its claims satisfied or discharged or till Engineer-in- Charge on behalf of the Government certified that the terms and conditions of the said agreement have been fully and properly carried out by the said Contractor(s) and accordingly discharges this guarantee.
5. We,.....(indicate the name of the Bank) further agree with the Government that the Government shall have the fullest liberty without our consent and without affecting in any manner our obligation hereunder to vary any of the terms and conditions of the said agreement or to extend time of performance by the said Contractor(s) from time to time or to postpone for any time or from time to time any of the powers exercisable by the Government against the said contractor(s) and to forbear or enforce any of the terms and conditions relating to the said agreement and we shall not be relieved from our liability by reason of any such variation, or extension being granted to the said Contractor(s) or for any forbearance, act of omission on the part of the Government or any indulgence by the Government to the said Contractor(s) or by any such matter or thing whatsoever which under the law relating to sureties would, but for this provision, have effect of so relieving us.
6. This guarantee will not be discharged due to the change in the constitution of the Bank or the Contractor(s).
7. We,..... (indicate the name of the Bank) lastly undertake not to revoke this guarantee except with the previous consent of the Government in writing.
8. This guarantee shall be valid up to..... unless extended on demand by the Government. Notwithstanding anything mentioned above, our liability against this guarantee is restricted to Rs. …… (Rupees.....)

PROFORMA OFSCHEDULES

(Separate Performa for Civil, Elect. & Hort. Works in case of Composite Tenders)

SCHEDULE 'A'

Schedule of quantities (as per PWD-3)

SCHEDULE 'D'

Extra schedule for specific requirements/document for the work, if any.

SCHEDULE 'E'

Reference to General Conditions of contract

Name of work: ....

....

Estimated cost of work: Rs. .....

(i) Earnest money: Rs. .....(To be returned after receiving performance guarantee)

(ii) Performance Guarantee : 5% of tendered value.

(iii) Security Deposit : 5% of tendered value.

SCHEDULE 'F'

GENERAL RULES & DIRECTIONS: Officer inviting tender .....

Maximum percentage for quantity of items of work to be executed beyond which rates are to be determined in accordance with Clauses 12.2 & 12.3. See below

Definitions:

2(v) Engineer-in-Charge .....

2(viii) Accepting Authority .....

2(x) Percentage on cost of materials and 15% labour to cover all overheads and profits.

2(xi) Standard Schedule of Rates .....

2(xii) Department .....

9(ii) Standard CPWD contract Form GCC 2019,
CPWD Form 7/ 8 as modified & corrected up to .....

Clause 1

(iv) Time allowed for submission of Performance Guarantee, programme chart (Time and progress) and applicable labour licenses, registration with EPFO, ESIC and BOCW welfare board or proof of applying there of from the date of issue of letter of acceptance .....days

(v) Maximum allowable extension with late fee @ 0.1% per day of Performance Guarantee amount beyond the period provided in (i) above .....days

(1 to 15 days to be filled by NIT approving authority)

Clause 2

Authority for fixing compensation under clause 2. .....

Clause 2A

Applicable clause 2/ Clause 2A Yes / No

Clause 5

Number of days from the date of issue of letter of acceptance for reckoning date of start Milestone(s) as per table given below: - .....day

SI No.	Description of Milestone (Physical)	Time Allowed in days (from date of start)	Amount to be with-held in case o non-achievement of milestone
1.	Proposed Additional & Modifications Works to Existing MDC Block @ Survey No 47, Mahanthalingapura Village, Jigan Hobli Anekal Taluk, Bengaluru urban district.	5 months	Compensation @ 1 % per month o delay For delay of work to be computed on per day basis
2.			
3.			
4.			

Time allowed for execution of work. .....

Authority to decide:

(i) Extension of time..... (Engineer in Charge or Engineer in Charge of Major Component in case of Composite Contracts, as the case may be)

(ii) Rescheduling of milestones ..... (Superintending Engineer/PM/CPM in Charge or Superintending Engineer in Charge of Major Component in case of Composite Contracts, as the case may be)

(iii) Shifting of date of start in case of delay in handing over of site (Superintending

Engineer/ PM/CPM in Charge or Superintending Engineer/ PM/CPM in Charge of Major Component in case of Composite Contracts, as the case may be)

PROFORMA OF SCHEDULES Clause 5 Schedule of handing over of site

Part	Portion of site	Description	Time Period for handing ove reckoned from date of issue of lette of intent.
Part A	Portion without any hindrance		
Part B	Portions with encumbrances		
Part C	Portions dependent on work o other agencies		

Clause 5

Applicable clause 5/ Clause 5A

Clause 7

Gross work to be done together with net payment /Adjustment of advances for material collected, if any, since the last such payment for being eligible to interim payment Rs. .....

Clause 7A

Whether clause 7A shall be applicable yes/No

Clause 10A

List of testing equipment to be provided by the contractor at site lab.

1. ..... 2. ..... 3. ……

4. ..... 5. ..... 6. ……

Clause 10B(ii)

Whether Clause 10 B (ii) shall be applicable Yes/No

Clause 10C

Component of labour expressed as percent of value of work: = ... %

Clause 10CC Applicable/ Not Applicable

Schedule of component of other Materials, Labour etc. for price escalation.

Component of civil (except materials covered

under clause 10CA)/Electrical construction Xm .....%

value of work. - Component of Labour -

expressed as percent of total value of work. Y .....%

Note: Xm..... % should be equal to (100) - (materials covered under clause 10CA i.e. Cement, Steel, POL and other material specified in clause 10CA + Component of Labour)

Clause 11

Specifications to be followed for execution of work .....

.

Clause 12

Authority to decide deviation up to 1.5 times of tendered amount .....

.

12.2 & 12.3 Deviation Limit beyond which clauses 12.2 & 12.3 shall apply for building work .....

12.5 (i) Deviation Limit beyond which clauses 12.2 & 12.3 shall apply for foundation work .....
(Except items mentioned in earth work subhead in DSR and related items)

(ii) Deviation Limit for items mentioned in earth work subhead of DSR and related items .....

Clause 16

Competent Authority for deciding reduced rates .....

Clause 18

List of mandatory machinery, tools & plants to be deployed by the contractor at site:

1	2	3 .....
4	5	6 .....
7	8	9 .....

Clause 19C .....authority to decide penalty for each default

Clause 19D .....authority to decide penalty for each default

Clause 19G .....authority to decide penalty for each default

Clause 19K .....authority to decide penalty for each default

Clause 2 Constitution of Dispute Redressal Committee (DRC) Chairman - .....

Member - .....

Member - .....

Clause 32

Requirement of Technical Representative(s) and recovery Rate

Sl No.	Minimum Qualification of Technical Representative	Discipline	Designation (Principal Technical /Technical representative)	Minimum	Number	Rate at which recovery shall be made from the contractor in the event of not fulfilling provision of clause 36(i)	
						Figures	Words
1.							
2.							
3.							
4							
5							

Assistant Engineers retired from Government services that are holding Diploma will be treated at par with Graduate Engineers.

Diploma holder with minimum 10-year relevant experience with a reputed construction co. can be treated at par with Graduate Engineers for the purpose of such deployment subject to the condition that such diploma holders should not exceed 50% of requirement of degree engineers.

Clause 38

(i) (a) Schedule/statement for determining theoretical quantity of cement & bitumen on the basis of Delhi Schedule of Rates.....printed by C.P.W.D.

(ii) (ii) Variations permissible on theoretical quantities:

(a) Cement

For works with estimated cost put to tender not more than Rs. 25 lakh. 3% plus/minus.

For works with estimated cost put to tender more than Rs. 25 lakh.. 2% plus/minus.

(b) Bitumen All Works 2.5% plus & only & nil on minus side.

(c) Steel Reinforcement and structural steel sections for each diameter, section and category 2% plus/minus

(d) All other materials. Nil

9 (b). SPECIAL CONDITIONS OF CONTRACT

.

1) Contractor to use only approved quality of treated water on construction works as per prevailing norms or as amended in force.
2) All construction debris/surplus excavated earth to be dumped only in the BBMP authorized places.

.

3) Contractor should open a Bank account in State Bank of India at IIMB for receipt/transfer of all payments on works.
4) The Contractor should furnish the details of utilization of payments received from IIMB on IIMB works only. The transfer of payments to other than IIMB works will not be permitted.
5) The pre-qualified agencies are requested to inspect the proposed construction site before participating in the bidding to ascertain the existing service lines in and around the building, the shifting of service lines without causing inconvenience to the user dept, it should be done without any extra cost.
6) The contractor should provide acoustical cover basement for construction equipment's cutting sound above higher decibels at his cost.
7) The contractor should use only approved brand / make chemicals as specified in the agreement for admixtures and grouts etc.

a) The contractor should furnish design mix for different grades of concrete before using on the works for approval.
b) Batching plant at site can also be established as per the details approved by Project Team.
c) The brand of cement to be used for RMC shall be 43/53 grade OPC & approved makes are Corramandel, Birla Super, ACC, L&T Ultratech, Zuari ,Bharathi, Ambuja, JK Cements & Dalmia.

8) The tender rates will be paid on the quantities executed upto tender quantities + 25%.
    a. Non Tender Items the least of the following rates will be paid
        i. Derived rate from the similar items of works.
        ii. KPWD rates plus tender premium.
        iii. Observed data on material & labor plus 15%
        iv. DSR / Justified rates.
9) The contractor should set up an QC Lab for day to day checking of the quality assurances on building materials or should get it tested from the reputed lab as approved. MOU with the reputed lab to be furnished.
10) The debris at site has to be got cleaned on weekly basis without fail. Any balance works not executed in approved frame will be got done by other agencies at the risk and cost of the approved tenderer. Hygienic atmosphere to be maintained at site.
11) All exposed concrete surfaces should be provided with special and approved shuttering systems for which shop drawings to be furnished for approval. The photo of the exposed concrete surface is enclosed in the tender drgs for reference, any exposed concrete not confirming to the above has to be removed and redone by the contractor at his cost.
12) The contractor should furnish the schedule for completion of work on a day- to-day / weekly basis report on the men and machinery deployed for the work duly signed by the authorized representatives.

13) TIME IS THE ESSENCE OF THE CONTRACT. Below the duration of construction works.

Sl.no.	Name of work	Period of construction including monsoon
1	Proposed Additional & Modifications Works to Existing MDC Block @ Survey No 47, Mahanthalingapura Village, Jigani Hobli Anekal Taluk, Bengaluru urban district	5 months

14) IIMB will employ other contractors/ agencies to execute various other parallel service activities relating to the works. The successful contractor / contractors for this contract shall work in close coordination with any other contractor / sub-contractor / agencies engaged by IIMB at site.
15) The scope / Magnitude of work will be defined by IIMB upon priority and work shall be assigned to the successful contractor accordingly and shall be binding on the contractor.

16) If the contractor does not have any query / request for clarification, it will be understood that he has gone through all the relevant clauses and he is satisfied. No claims or misinterpretation of words will be entertained after award of work.
17) The Employers do not bind themselves to accept the lowest or any tender and reserve themselves that right to accept or reject any or all the tenders, whether in whole or in part without assigning any reason for doing so.
18) The contractor should put his signature and seal of the company in all the pages of the financial e-bidding document without quoting the rates.
19) All the service contractors and sub-contractors for specialized jobs should be approved by the Clients / Architects.
20) The rates quoted shall include and shall be deemed to have included all taxes including the taxes on works contract, labor cess,excise duty, Octroi duty, fees, royalties, and any other duties or fees whatsoever leviable under the State or Central Govt. or any other local authorities. The rates shall also include & shall be deemed to have included any other expenses like transportation of materials to the work site, handling, loading and unloading thereof and taxes, duties, royalties, fees, whatsoever on materials. It shall be the responsibility of the contractor to bear any increases at a future date after opening of tenders in the rates of taxes, duties, royalties, fees etc. new taxes, duties, royalties, fees etc. by any Govt. / Local authorities.
21) Please Note: GST shall be indicated separately.
22) The rates quoted shall be for execution of finished items of works as indicated in the Bill of Quantities, which include cost of all materials, consumables, labors, plants, equipment, machineries, transportation of materials to site, loading, unloading, testing of materials and works, samples for testing, all taxes, duties, royalties, Octroi, cost of incidental charges on tools / plants, cost of labor, contractor's overheads, profit etc. to complete the item as per stipulated specifications & description in Bill of Quantities.
23) Should a contractor find discrepancies or omissions in the drawings or in the tender documents or should be in doubt as to their meaning he should address the authority inviting tender, for clarification. Every endeavor is made to avoid any errors which can materially affect the basis of the tender but the successful contractor shall take upon himself the risk of any error which may be subsequently discovered and shall make no subsequent claim on account thereof. The decision of the Engineer-in-charge shall be final and binding on the contractor in this respect.

24) Any tender not accompanied by an acceptable Earnest Money Deposit and not secured in the payment modes as indicated shall be rejected by the IIMB as non-responsive.
25) The Earnest Money Deposit shall be forfeited:
    (a) If the contractor withdraws from the Tender after tender opening during the period of tender validity, which is 120 Days from the Date of Opening of Financial E-Bidding.
    (b) In the case of a successful contractor, if the contractor fails within the specified time limit to sign the Agreement;
    (c) In case the contractor, after quoting, withdraws from the tender or refuses/delays in commencing the work or stops the work abruptly, such contractor's EMD/ SD, as the case may be, will be forfeited.
    (d) If a contractor withdraws his offer after submission of his tender, fails to start the work in accordance with the instructions of the Engineer-in-Charge, the Earnest money deposited by him may be forfeited without prejudice to any other remedy available to the company under the contract.
26) Earnest Money Deposit is compulsory for all the contractors including State Government / Statutory Bodies / Enterprises / Undertakings etc
27) Contractors may note the fact that their registrations with any other authority do not entitle them from exemption from payment of EMD.
28) RETURN OF EMD:
29) Unsuccessful Contractors: The Earnest Money Deposit (EMD) will be returned to the unsuccessful contractors after the issue of Letter of Award (LOA) to successful contractor.
30) Bank Details: The contractors are required to submit the bank details along with the Financial Bid. The bank details are required to be filled in and submitted in the company letterhead, duly attested by the authorized person of the company and the banker. The bank details should be accompanied by a cancelled cheque duly attested by the banker.

31) Successful Contractor should furnish schedule in MS project/ Barcharts/PERT/CPM for the completion of works duly signed with seal.
32) In case of submission of EMD through Demand Draft and Bank Guarantee:
33) EMD will be returned to the L1 contractor on submission of the Bank Guarantee (Performance) at 3% (three percent) of the value of the LOA valid up to the completion of the defects liability period of 12 months plus two months.
34) Note: The Performance Bank Guarantee should be submitted within 15 days after receipt of the Letter Of Award.
35) PERFORMANCE GUARANTEE AND SECURITY DEPOSIT:
36) Performance Guarantee: The successful tenderer shall furnish a Performance Bond in the format as acceptable by the Employer, for a sum of 5% of the Contract Value (Refer Clause – 1 of General Conditions of Contract for CPWD works) from any scheduled bank valid for the period as mentioned below within Fifteen
37) This shall be released after the virtual completion of the work plus defects liability period. If the work is not completed within the stipulated duration, the bank guarantee should be extended for the corresponding extension period.
38) The performance bond of the successful tenderer will be forfeited, if he fails to comply with any of the conditions of the contract.
39) Security Deposit/Retention amount: 5% (Five percent) of the gross bill value shall be retained in cash from each running bill towards retention money up to a maximum limit of 5% of the Contract value. The retention amount shall be released after the defects liability period.
40) Defects Liability period : 12 (Twelve) Months from the Date of Virtual Completion.
41) During the defects liability period / maintenance period, the contractor shall be responsible to make good, free of cost, all defects or damages which occur due to defective workmanship / materials. If the contractor fails to make good such defects or damages even after intimation to him within a reasonable time, IIMB shall get the same rectified as deemed fit at the contractors' risk and the expenditure incurred by IIMB shall be recovered from any bills or deposits of the contractor either pertaining to this contract or from any other contracts or in case any such sum being insufficient or not available for the recovery / deductions the expenditure incurred by IIMB shall be deemed as a debt due.
42) The contractor shall consider and include all his claims whatsoever in his final bill which shall construe and mean that the contractor shall not have any other claims whatsoever against IIMB other than those indicated in the final bill. **"NO DEMAND CERTIFICATE"** stating that he has no other claims on IIMB, except the claims indicated in the final bill, and defects liability amount should be submitted along with the final bill.
43) If the contractor desires to entrust his affairs to any person, a power of attorney duly authenticated by a Magistrate / Notary / Court / Judge in favor of such person, shall be submitted to IIMB, acceptance of which shall be at the discretion of the Accepting Officer.
44) The contractor shall make all arrangements for execution of agreement at his own cost, using IIMB standard format on appropriate stamp paper and execute the same within 15 days from acceptance of Tender. Value of the stamp paper will be informed in the LOA issued to the successful contractor.
45) Several documents forming the contract are to be taken as mutually explanatory to one another. Detailed drawings and figured dimension in the drawings shall be followed, not scaling the drawing.
46) If there are varying or conflicting provisions made in any one of the documents forming part of the contract or otherwise, the following precedence shall be observed:

a) Tender Notice and Instructions to Contractors shall have precedence over Special and General Conditions.
b) Specification in Schedule (Bill of Quantities) shall have precedence over Particular Specifications and Drawing.
c) Special Conditions shall have precedence over General Conditions and Minutes of Pre-Bid meeting will form a part of the agreement.
d) In regard to the Conditions, specification and mode of measurement not covered above, the CPWD – DSR shall apply.
e) In regard to the specification & mode of measurement not covered above, IS shall apply.

47) However, the Project Manager shall be the sole deciding authority with regard to the intention of the document and his decision in this respect shall be final and binding to the Contractor.

48) The contractor shall not increase his quoted rates in case the accepting officer negotiates for reduction of rates. Such negotiations shall not amount to cancellation or withdrawal of the original offer and the rates originally quoted shall be valid for a period of 90 days from the date of opening of tenders.
49) Canvassing in any form in connection with the tenders is strictly prohibited and the tenders submitted by the contractors who resort to canvassing will be liable to be rejected.
50) Whenever the Project Manager of the work feels it necessary and advises the contractor for production of bills for any materials whatsoever procured / purchased by the contractor for use and incorporation in the work, the contractor shall produce such bills in proof of such purchase / procurement from bonafide dealers/manufacturers. Such a demand for production of bill can be made by the Project Manager even after use and incorporation of such materials in the work, after clearance by the Project Manager for the quality of the materials. In the event of such a demand by the Engineer-in-charge for production of bills, the contractor shall not use and incorporate such materials in the work without the prior clearance in writing from the Project Manager. In case, the contractor fails to produce the bills or uses / incorporates the materials in the work against which bills are advised to be produced, without prior clearance of Project Manager, no payment against any work under the contract executed by the contractor shall be made.
51) The contractor must obtain for himself on his own responsibility and at his own expenses all the information which may be necessary for the purpose of making a tender and for entering into contract and must examine the entire tender document, inspect the site of the work and acquaint himself with all the information about scope and specifications of the work to be done, all his obligations under the contract, local, hydrological and climatic conditions, local and statutory/ Govt. rules and regulations, all other local conditions, means of access to the work, security requirements, restrictions in entry to the Project site, conditions of site of work, nature of the work and all matters pertaining thereto.
52) Access to the site will be given during the tender period by appointment on application to the authority issuing the tender. The contractor shall ascertain the location, size and condition of the areas available for his use as working areas and all other information affecting this tender.
53) The contractors must note that information, if any, as regards to the site and local conditions, as contained in these tender documents has been given merely to assist the contractors and is not deemed to be complete.
54) The contractors should note and bear in mind that IIMB shall bear no responsibility for the lack of acquaintance of the site and other conditions or any information relating thereto, on its part. The consequences of the lack of any knowledge, as aforesaid, on the part of the contractors shall be at their risk and cost and no charges or claims
55) Whatsoever consequent upon the lack of any information, knowledge or understanding shall be entertained or payable by IIMB either during tender stage or during the construction period.
56) Only those tenders fully completed in all respects, with the necessary information duly filled-in, signed and sealed on every page, together with all the documents and received by the time and date specified hereunder/hereafter will be considered.
57) All information supporting the tender shall be in English and all entries are to be typewritten. There shall be no over-writing or erasure. All corrections should be attested by the contractor with his dated initials as many times as the corrections occur.
58) Contractor are required to sign with stamp on every page of the bid document including the drawings attached thereto and any common set of deviations / corrigendum / addendum issued by IIMB. All corrections in the bid documents must also be signed by the contractor.
59) The Security deposit recovered will be released upon vitual complation of work against BG valid for the prescribed period.
60) Contractor should provide vehicle arrangements to Project Manager & team for Inspection of Materials/testing facilities @ his cost
61) The contractor has to maintain list of registers on the work/materials/labour etc as per formate furnished by project team.
62) The quoted rates are firm for the tender period & for approved extended period, cost will not be paid against any labour unrest of any materials supplier strike etc
63) The Minutes of Prebid meeting will form part of the agreement.

PART A :TECHNICAL SPECIFICATION FOR CIVIL WORKS

"**S P E C I F I C A T I O N**"

GENERAL :

1.1 The detailed specifications given hereafter are for the items of works described in the schedule of quantities attached herein, and shall be guidance for proper execution of work to the required standards.

1.2 It may also be noted that the specification are of generalized nature and these shall be read in conjunction with the description of item in schedule of quantities and drawings.

1.3 The work also includes all minor details of construction which are obviously and fairly intended and which may not have been referred to in these documents but are essential for the entire completion in accordance with standard engineering practice.

1.4 The Director, IIMB, shall be the sole deciding authority as to the meaning, interpretations and implication for various provisions of the specifications and his decision in writing shall be final and binding on all concerned.

1.5 In case any difference or discrepancy between the specifications and the description in the schedule of quantities, the schedule of quantities shall take precedence.

1.6 In case any difference or discrepancy between the specifications and the drawing, the specification shall take precedence.

1.7 Unless specifically otherwise mentioned, all the applicable latest codes and standards published by the Bureau of Indian Standards and all other standards, shall govern in all respects of design, workmanship, quality, properties of materials, method of testing and method of measurements.

* * * * *

1.0 CARRIAGE OF MATERIALS

1.0 GENERAL

The carriage and stacking of materials shall be done as directed by the Project Manager. Any tools and plants, required for the work shall be arranged by the Contractor. The carriage of materials includes loading within a lead of 50 meters, unloading and stacking within a lead of 50 meters.

1.1 RESPONSIBILITY FOR LOSS OR DAMAGE

Loading, carriage, unloading and stacking shall be done carefully to avoid loss or damage to the materials. In case of any loss or damage, recovery shall be affected from the Contractor at twice the issue rates of the materials. If the issue rates of the materials are not available then the recovery shall be affected at twice the prevailing market rates as determined by the Project Manager.

1.2 MODE OF CARRIAGE

Depending upon the feasibility and economy, the Project Manager shall determine the mode of carriage viz. whether by mechanical or manual labor.

1.3 LEAD

1.3.1 All distances shall be measured over the shortest practical route and not necessarily the route actually taken. *Route other than shortest practical route may be considered in cases of unavoidable circumstances and as approved by Project Manager along with reasons in writing.*

1.3.2 Carriage by manual labor shall be reckoned in units of 50 meters or part thereof.

1.3.3 Carriage by mechanical transport shall be reckoned in one km unit. Distances of 0.5 km or more shall be taken as 1 km and distance of less than 0.5 km shall be ignored. However, when the total lead is less than 0.5 km, it will not be ignored but paid for separately in successive stages of 50 meters subject to the condition that the rate worked on this basis does not exceed the rate for initial lead of 1 km by mechanical/ manual transport.

1.4 GENERAL CONSIDERATION FOR STACKING AND STORAGE

1.4.1 Planning of Storage Layout

For any site, there should be proper planning of the layout for stacking and storage of different materials, components and equipment's with proper access and proper maneuverability of the vehicles carrying the material. While planning the layout, the requirements of various materials, components and equipment's at different stages of construction shall be considered. The storage & stacking check list is given in Table 1.1. For further details refer IS- 4082.

1.4.2 Material shall be stored in such a manner as to prevent deterioration or intrusion of foreign matter and to ensure the preservation of their quality and fitness for the work.

1.5 PROTECTION AGAINST ATMOSPHERIC AGENCIES

Materials stored at site, depending upon the individual characteristics, shall be protected from atmospheric actions, such as rain, sun, winds and moisture to avoid deterioration.

1.6 PROTECTION AGAINST FIRE AND OTHER HAZARDS

1.6.1 Materials like timber, coal, paints, etc. shall be stored in such a way that there may not be any possibility of fire hazards. Inflammable materials like kerosene and petrol shall be stored in accordance with the relevant rules and regulations so as to ensure the desired safety during storage. Stacks shall not be piled so high as to make them unstable under fire fighting conditions and in general they shall not be more than 4.5 m in height. The provisions given in IS 13416 (part 5) shall be followed.

1.7 STACKING AND STORAGE OF MATERIALS

1.7.1 Cement

1.7.1.1 In case cement is received in bags. Cement shall be stored at the work site in a building or a shed which is dry, leak-proof and as moisture proof as possible. The building or shed for storage should have minimum number of windows and close fitting doors and these should be kept closed as far as possible.
1.7.1.2 Cement shall be stored and stacked in bags and shall be kept free from the possibility of any dampness or moisture coming in contact with them. Cement bags shall be stacked off the floor on wooden planks in such a way as to keep about 150 mm to 200 mm clear above the floor. The floor may comprise of lean cement concrete or two layers of dry bricks laid on well consolidated earth. A space of 600 mm minimum shall be left alround between the exterior walls and the stacks (see Fig. 1.1) In the stacks the cement bags shall be kept close together to reduce circulation of air as much as possible. Owing to pressure on the bottom layer of bags sometimes 'warehouse pack' is developed in these bags. This can be removed easily by rolling the bags when the cement is taken out for use. Lumbed bags, if any should be removed and disposed off.

1.7.1.3 The height of stack shall not be more than 10 bags to prevent the possibility of lumping up under pressure. The width of the stack shall be not more than four bags length or 3 meters. In stacks more than 8 bags high, the cement bags shall be arranged alternately length-wise and cross-wise so as to tie the stacks together and minimize the danger of topping over. Cement bags shall be stacked in a manner to facilitate their removal and use in the order in which they are received; a lable showing date of receipt of cement shall be put on each stack to know the age of cement.

1.7.1.4 For extra safety during the monsoon, or when it is expected to store for an unusually long period, the stack shall be completely enclosed by a water proofing membrane such as polyethylene, which shall close on the top of the stack. Care shall be taken to see that the waterproofing membrane is not damaged any time during use.

1.7.1.5 Cement in gunny bags, paper bags and polyethylene bags shall be stored separately.

1.7.2 In case cement is received in drums
These shall be stored on plane level ground, as far as possible near the concrete mixing place. After taking out the required quantity of cement, the lid of the drum shall be securely tied to prevent ingress of moisture.

1.7.3 In case cement is received in silos
The silos shall be placed near the concrete batching plant. Proper access shall be provided for the replacement of silos.

1.7.4 Different types of cements shall be stacked and stored separately.

1.8 BRICKS
1.8.1 Bricks shall be stacked in regular tiers as and when they are unloaded to minimize breakage and defacement. These shall not be dumped at site.

1.8.2 Bricks stacks shall be placed close to the site of work so that least effort is required to unload and transport the bricks again by loading on pallets or in barrows. Building bricks shall be loaded or unloaded a pair at a time unless palletized. Unloading of building bricks or handling in any other way likely to damage the corners or edges or other parts of bricks shall not be permitted.

1.8.3 Bricks shall be stacked on dry firm ground. For proper inspection of quality and ease in counting the stacks shall be 50 bricks long, 10 bricks high and not more than 4 bricks in width, the bricks being placed on edge, two at a time along the width of the stack. Clear distance between adjacent stacks shall not be less than 0.8 m. Bricks of each truck load shall be put in one stack.

1.8.4 Bricks of different types, such as clay bricks, clay fly ash bricks, fly ash lime bricks, sand lime (calcium silicate) bricks, auto-clave bricks etc. shall be stacked separately. Bricks of different classification and size consideration (such as, conventional and modular) shall be stacked separately. Also bricks of different types, such as, solid, hollow and perforated shall be stacked separately.

1.9 BLOCKS

1.9.1 Blocks are available as hollow and solid concrete blocks, hollow and solid light weight concrete blocks, autoclaved aerated concrete blocks, concrete stone masonry blocks and soil based blocks.

1.9.2 Blocks shall be unloaded one at a time and stacked in regular tiers to minimize breakage and defacement. These shall not be dumped at site. The height of the stack shall not be more than 1.2 m. The length of the stack shall not be more than 3.0 m, as far as possible and the width shall be of two or three blocks.

1.9.3 Normally blocks cured for 28 days only should be received at site. In case blocks cured for less than 28 days are received, these shall be stacked separately. All blocks should be water cured for 10 to 14 days and air cured for another 15 days; thus no blocks with less than 28 days curing shall be used in building construction.

1.9.4 Blocks shall be placed close to the site of work so that least effort is required for their transportation.

1.9.5 Blocks manufactured at site shall be stacked at least for required minimum curing period as given in 1.9.3.

1.9.6 The date of manufacture of the blocks shall be suitably marked on the stacks of blocks manufactured at factory or site.

1.10 FLOOR, WALL AND ROOF TILES

1.10.1 Floor, wall and clay roof tiles of different types, such as, cement concrete tiles (plain, colored and terrazzo) and ceramic tiles (glazed and unglazed) shall be stacked on regular platform as far as possible under cover in proper layers and in tiers and they shall not be dumped in heaps. In the stack, the tiles shall be so placed that the mould surface of one faces that of another. Height of the stack shall not be more than one meter. During unloading, these shall be handled carefully so as to avoid breakage.

1.10.2 Tiles of different quality, size and thickness shall be stacked separately to facilitate easy removal for use in work. Tiles when supplied by manufacturers packed in wooden crates shall be stored in crates. The crates shall be opened one at a time as and when required for use.

1.10.3 Ceramic tiles and clay roof tiles are generally supplied in cartons which shall be handled with care. It is preferable to transport these at the site on platform trolleys.

1.11 AGGREGATES

1.11.1 Aggregates shall be stored at site on a hard dry and level patch of ground. If such a surface is not available, a platform of planks or old corrugated iron sheets, or a floor of bricks, or a thin layer of lean concrete shall be made so as to prevent contamination with clay, dust, vegetable and other foreign matter.

1.11.2 Stacks of fine and coarse aggregates shall be kept in separate stock piles sufficiently removed from each other to prevent the material at the edges of the piles from getting intermixed. On a large job, it is desirable to construct dividing walls to give each type of aggregates its own compartment. Fine aggregates shall be stacked in a place where loss due to the effect of wind is minimum.

1.11.3 Unless specified otherwise or necessitated by site conditions stacking of the aggregates should be carried out in regular stacks. The suggested sizes for stacks are as follows :

Sl. no.	**Material**	**Size of Stack (in m)**		
		Length	Breadth	Height
(i)	Soling stone Or	5.0 5.0	2.0 1.0	0.50 0.50
(ii)	Coarse aggregates Or Or	2.0 5.0 5.0	2.0 5.0 1.0	0.50 1.00 0.50
(iii)	Fine aggregates Or Or	2.0 5.0 5.0	2.0 5.0 1.0	0.50 1.00 0.50

1.12 FLY ASH
Fly ash shall be stored in such a manner as to permit easy access for proper inspection and identification of each consignment. Fly ash in bulk quantities shall be stored in stack similar to fine aggregates as specified in 1.11 to avoid any intrusion of foreign matter. Fly ash in bags shall be stored in stacks not more than 10 bags high.

1.13 STEEL
1.13.1 For each classification of steel, separate areas shall be earmarked. It is desirable that ends of bars and sections of each class be painted in distinct separate colors.
1.13.2 Steel reinforcement shall ordinarily be stored in such a way as to avoid distortion and to prevent deterioration and corrosion. It is desirable to coat reinforcement with cement wash before stacking to prevent scaling and rusting.
1.13.3 Bars of different classification, sizes and lengths shall be stored separately to facilitate issues in such sizes and lengths so as to minimize wastage in cutting from standard lengths.

1.13.4 In case of long storage, reinforcement bars shall be stacked above ground level by at least 150 mm. Also in coastal areas or in case of long storage a coat of cement wash shall be given to prevent scaling and rusting.

1.13.5 Structural steel of different classification, sizes and lengths shall be stored separately. It shall be stored above ground level by at least 150 mm upon platforms, skids or any other suitable supports to avoid distortion of sections. In coastal areas or in case of long storage suitable protective coating of primer paint shall be given to prevent scaling and rusting.

1.14 ALUMINIUM SECTIONS
Aluminum sections of different classification, sizes and lengths shall be stored separately, on a level platform under cover. The aluminum sections shall not be pulled or pushed from the stack nor shall be slided over each other, to protect the anodizing layer.

1.15 DOORS, WINDOWS AND VENTILATORS
1.15.1 General
While unloading, shifting handling and stacking timber or other lignocellulosic material based, metal and plastic door and window frames and shutters, care shall be taken that the material is not dragged one over the other as it may cause damage to the surface of the material particularly in the case of decorative shutters. The material should be lifted and carried preferably flat avoiding damage of corners or sides.

1.15.2 Metal and plastic doors, windows and ventilators shall be stacked upright (on their sills) on level ground preferably on wooden battens and shall not come in contact with dirt and ashes. If received in crates they shall be stacked according to manufacturer’s instructions and removed from the crates as and when required for the work.

1.15.3 Metal and plastic frames of doors, windows and ventilators shall be stacked upside down with the kick plates at the top. These shall not be allowed to stand for long in this manner before being fixed so as to avoid the door frames getting out of shape and hinges being strained and shutters drooping.

1.15.4 During the period of storage all metal doors, windows and ventilators shall be protected from loose cement and mortar by suitable covering such as tarpaulin. The tarpaulin shall be hung loosely on temporary framing to permit circulation of air to prevent condensation.

1.15.5 All timber and other lignocellulosic material based frames and shutters shall be stored in a dry and clean covered space away from any infestation and dampness. The storage shall preferably be in well ventilated dry rooms. The frames shall be stacked one over the other in vertical stacks with cross battens at regular distances to keep the stack vertical and straight. These cross battens should be of uniform thickness and placed vertically one above the other. The door shutters shall be stacked in the form of clean vertical stacks over the other and

at least 80 mm above ground on pallets or suitable beams or rafters. The top of the stack shall be covered by a protecting cover and weighted down by means of scantlings or other suitable weights. The shutter stack shall rest on hard and level ground.

1.15.6 If any timber or other lignocellulosic material based frame or shutter becomes wet during transit, it shall be kept separate from the undamaged material. The wet material may be dried by stacking in shade with battens in between adjacent boards with free access of dry air generally following the guidance laid down in IS 1141.

1.15.7 Separate stacks shall be built up for each size, each grade and each type of material. When materials of different sizes grades and types are to be stacked in one stack due to shortage of space, the bigger size shall be stacked in the lower portion of the stacks. Suitable pallets or separating battens shall be kept in between the two types of material.

1.16 ROOFING SHEETS

1.16.1 Roofing sheets shall be stored and handled in such a manner as not do damage them in any way.

1.16.1 Plain and corrugated asbestos cement sheets shall be stacked horizontally to a height of not more than one meter on a firm and level ground, with timber or other packing beneath them. If stacked in exposed position, they shall be protected from damage by the winds.

Asbestos cement sheets of same variety and size shall be stacked together. Damage sheets shall not be stacked with sound materials. All damaged sheets shall be salvaged as early as possible.

1.16.2 Corrugated galvanized iron sheets and aluminum sheets shall be stacked horizontally to a height of not more than 0.5 m on a firm and level ground, with timber or other packing beneath them. To protect them from dust and rain water, these shall be covered with tarpaulin or polyethylene sheets.

1.16.3 Plastic sheets and glass reinforced plastic (GRP) sheets shall be stacked under a shed to a height of not more than 0.5 m on a firm and level ground with timber or other packing beneath them.

1.17 GYPSUM BOARDS, PLYWOOD, FIBREBOARD, PARTICLE BOARD, BLOCK BOARD, ETC.

1.17.1 These boards shall be stored flat in a covered clean and dry place. Different sizes and types of each of these boards shall be stacked separately.

The board shall be stacked on a flat platform on which a wooden frame shall be constructed with 50 mm x 25 mm battens in such a way that it will give support to all four edges and corners of the boards with intermediate battens placed at suitable intervals to avoid warping.

The boards shall be stacked in a solid block in a clear vertical alignment. The top sheet of each stack shall be suitably weighed down to prevent warping wherever necessary.

The boards shall be unloaded and stacked with utmost care avoiding damage to the corners and surface. In case of decorative plywood and decorative boards, the surfaces of which are likely to get damaged by dragging one sheet over another it is advisable that these are lifted as far as possible in pairs facing each other.

1.18 GLASS SHEETS

1.18.1 It is important that all glass sheets whether stored in crates or not shall be kept dry. Suitable covered storage space shall be provided for the safe storage of the glass sheets. In removing glass sheets from crates, great care shall be taken to avoid damages. The glass sheets shall be lifted and stored on its long edges against a vertical wall or other support with the first sheet so placed that its bottom edge is 25 mm from the vertical support. The stacks shall be of not more than 25 panes and shall be supported at two points by fillets of wood at 300 mm from each end. The whole stack shall be as close and as upright as possible.

The glass sheets of different sizes, thickness and type shall be stacked separately. The distance between any two stacks shall be of the order of 400 mm.

1.19 CAST IRON, GALVANIZED IRON AND ASBESTOS CEMENT PIPES AND FITTINGS

1.19.1 The pipes shall be unloaded where they are required when the trenches are ready to receive them.

1.19.2 Storage shall be done on firm, level and clear ground and wedges shall be provided at the bottom layer to keep the stack stable.

1.19.3 The stack shall be in pyramid shape or the pipes length-wise and cross-wise in alternate layers.

The pyramid stack is advisable in smaller diameter pipes for conserving space in storing them. The height of the stack shall not exceed 1.5 m.

1.19.4 Each stack shall contain only pipes of same class and size, with consignment or batch number marked on it with particulars of suppliers wherever possible.

1.19.5 Cast iron detachable joints and fittings shall be stacked under cover separately from the asbestos cement pipes and fittings.

1.19.6 Rubber rings shall be kept clean, away from grease, oil heat and light.

1.20 POLYETHYLENE PIPES

1.20.1 Natural polyethylene pipe should be stored under cover and protected from direct sunlight. However, black polyethylene pipes may be stored either under cover or in the open.

1.20.2 Coils may be stored either on edges or stacked flat one on top of the other, but in either case they should not be allowed to come into contact with hot water or steam pipes and should be kept away from hot surface.

1.20.3 Straight lengths should be stored on horizontal racks giving continuous support to prevent the pipe taking on a permanent set.

1.20.4 Storage of pipes in heated areas exceeding 27o C should be avoided.

1.21 UNPLASTICIZED PVC PIPES

1.21.1 The pipe should be given adequate support at all times. Pipes should be stored on a reasonably flat surface free from stones and sharp projections so that the pipe is supported throughout its length. In storage, pipe racks should be avoided. Pipe should not be stacked in large piles, especially under warm temperature conditions as the bottom pipes may distort, thus giving rise to difficulty in jointing. Socket and spigot pipes should be stacked in layers with sockets placed at alternate ends of the stacks to avoid lopsided stacks.

1.21.1.1 It is recommended not to store pipe inside another pipe.

1.21.1.2 On no account should pipes be stored in a stressed or bent condition or near the sources of heat.

1.21.1.3 Pipes should not be stacked more than 1.5 m high. Pipes of different sizes and classes should be stacked separately.

1.21.2 The ends of pipe should be protected from abrasion particularly those specially prepared for jointing either spigot or socket solvent welded joints or shouldered for use with couplings.

1.21.3 In tropical conditions, pipes should be stored in shade. In very cold weather, the impact strength of PVC is reduced making it brittle and more care in handling shall be exercised in wintry condition.

1.21.4 If due to unsatisfactory storage of handling a pipe becomes kinked, the damaged portion should be cut out completely. Kinking is likely to occur only on very thin walled pipes.

1.22 BITUMEN, ROAD TAR, ASPHALT, ETC.

1.22.1 All types of bitumen, road tar, asphalt, etc, in drums or containers shall be stacked vertically on their bottoms in up to 3 tiers. Leaky drums shall be segregated. Empty drums shall be stored in pyramidal stacks neatly in rows.

1.23 WATER

1.23.1 Wherever water is to be stored for construction purposes this shall be done in proper storage tanks to prevent any organic impurities getting mixed up with it.

1.24 OIL PAINTS

1.24.1 All containers of paints, thinners and allied materials shall preferably be stored in a separate room on floors with sand cushions. The room shall be well-ventilated and free from excessive heat, sparks of flame and direct rays of sun. The containers of paint shall be kept covered or properly fitted with lid and shall not be kept open except while using. The containers of paints have expiry date marked by the manufacturers, which should be highlighted so as to facilitate use of paint within due period.

1.25 SANITARY APPLIANCES

1.25.1 All sanitary appliances shall be carefully stored under cover to prevent damage. When accepting and storing appliances, advance planning shall be made regarding the sequence of removal from the store to the assembly positions. Supporting brackets shall be so stored as to be readily accessible for use with the appliances.

1.26 OTHER MATERIALS

1.26.1 Small articles like nails, screws, nuts and bolts, door and window fittings, polishing stones, protective clothing, spare parts of machinery, linings, packing, water supply and sanitary fittings, electrical fittings, insulation board, etc, shall be kept in suitable and properly protected store rooms. Valuable small material such as, copper pipes and fittings shall be kept under lock and key.

1.27 MEASUREMENTS

Length, breadth and height of stacks shall be measured correct to a cm. The quantity shall be worked out in cubic meter correct to two place of decimal. The volume of stacks shall be reduced by percentages as shown against each for looseness in stacking to arrive at the net quantity for payment.

No reduction shall be made in respect of articles or materials for which mode of payment is by length or weight or number.

1.27.1 Earth

In loose stacks such as cart loads, lorry loads, etc. – 20%
In fills consolidated by light mechanical machinery – 10%
In fills consolidated by heavy mechanical machinery but not under OMC (Optimum Moisture Content) – 5%
In fills consolidated by heavy mechanical machinery at OMC – Nil
Consolidated fills in confined situation such as under floors. etc. – Nil

Other Materials

Manure or sludge – 8%
Moorum, building rubbish Lime and sand – Nil
Stone metal, 40 mm nominal size and above – 7.5%
Coarse aggregate/ stone metal below 40 mm nominal size – Nil
Soling stone/ Boulder 100 mm and above – 15%
Excavated rocks – 50%

1.28 RATE

The rate for carriage of materials is inclusive of all the operations described above.

TABLE 1.1
Storage and Stacking Check List *(Clause 1.4.1)*

Sl. No.	Material / Component	Base			Stack				Type of cover		
		Firm Level Ground	Hard Floor	Off Floor	Heaps	Tiers	Flat	Vertical	Open	Open but covered	Under shed
1	Cement			✓		✓					✓
2	Stone and Aggregates										
a	Stones, aggregates, fly ash and cinder	✓			✓				✓		
b	Veneering stones	✓				✓		✓	✓		
3	Bricks and Blocks	✓				✓			✓		
4	Tiles										
a	Clay and concrete floor, wall and roof tiles	✓				✓	✓		✓		
b	Ceramic tiles		✓			✓	✓				✓
5	Steel	✓					✓		✓		
6	Aluminum Sections		✓				✓				✓
7	Door, windows and Ventilators		✓					✓			✓
8	Roofing Sheets										
a	AC	✓				✓	✓		✓		
b	GI and Aluminum Sheets	✓				✓	✓			✓	
c	Plastic Sheets			✓		✓	✓				✓
9	Boards like Plywood, Particle Boards, Fiber Boards, Blackboards and Gypsum Board			✓		✓	✓				✓
10	Glass Sheets		✓					✓			✓
11	CI, GI and AC Pipes & fittings										
a	Pipes	✓				✓	✓		✓		
b	CI and GI fittings		✓				✓				✓
c	AC Fittings		✓				✓		✓		
12	Polyethylene Pipes			✓		✓	✓				✓
13	Unplasticized PVC Pipes	✓				✓	✓		✓		

14	Bitumen, Road Tar, Asphalt, etc in Drums	✓				✓			✓		
15	Oil Paints		✓			✓					✓
16	Sanitary Appliances			✓			✓				✓

MORTARS

CONTENTS

LIST OF MANDATORY TESTS

Material	Clause	Test	Field/ Laboratory Test	Test Procedure	Min. quantity of material for carrying out test	Frequency of testing
1	*2*	*3*	*4*	*5*	*6*	*7*
Water	3.1.1	(i) pH Value (ii) Limits of Acidity (iii) Limits of Alkality (iv) Percentage of solids (a) Chlorides (b) Suspended matter (c) Sulphates (d) Inorganic solids (e) Organic solids	Lab Lab Lab Lab Lab Lab Lab Lab Lab	IS 3025	-	Water from each source shall be got tested before commencement of work and thereafter once in every 3 months till completion of work. Water from municipal source need be tested only once in six months. Number of Tests for each source shall be 3

Cement	3.1.2	(a) Physical requirement (i) Fineness (ii) Soundness (iii) Setting time (Initial & Final) (iv) Compressive strength (v) Consistency of standard cement paste	Lab Lab Lab Lab Lab	 IS 4031 (Part II) IS 4031 (Part III) IS 4031 (Part V) IS 4031 (Part VI) IS 4031 (Part VI)	Each lot	Every 50 tones or part thereof. Each brand of cement brought to site shall be tested as per this frequency.
Sand	3.1.3.1	Organic impurities	Field	Appendix 'A'	20 cum	Every 20 cum or part thereof or more frequently as decided by Project Manager
	3.1.3.2	Silt Content	Field	Appendix C	20 cum	-do-
	3.1.3.4	Particle size distribution a, b, c, d & e	Field or Laboratory as decided by the Project Manager	Appendix B	40 cum	40 cum or part thereof
Sand	3.1.3.5	Bulking of Sand	Field	Appendix D	20 cum	Every 20 cum or part thereof or more frequently as decided by Project Manager
Fly Ash	3.1.5 & 3.1.5.1	Total chloride in percent by mass, max.	Lab	IS 12423	10 cum	Every 10 cum or part thereof or more
		Loss of ignition in percent by mass, max.	Lab	IS 1727	10 cum	Frequency as decided by Project Manager
		Fineness, specific surface in m^2/kg	Lab/field	Blaine's permeability method	10 cum	-do-
		Compressive strength at 28 days in N/mm^2, min	Lab.	-	10 cum	Only in cases when fly ash is used as pozzolana in cement

LIST OF BUREAU OF INDIAN STANDARD CODES

S. No.	***I.S. No.***	***Subject***
1	IS 269	Specification for 33 grade ordinary Portland cement
2	IS 383	Specification for coarse and fine aggregate from natural Source for concrete.
3	IS 455	Specification for Portland slag cement.
4	IS 460 (Part I)	Specification for test sieves: wire cloth test sieves.
5	IS 650	Specification for standard sand for testing of cement
6	IS 1269	Specification for 53 grade ordinary Portland cement
7	IS 1344	Specification for calcined clay Pozzolana.
8	IS 1489	Specification for Portland pozzolana cement
9	IS 1542	Specification for sand for plaster
10	IS 1727	Methods of Test for Pozzolanic materials

11	IS 2116	Specification for sand for masonry mortar.
12	IS 2250	Code of practice for preparation and use of masonry Mortar.
13	IS 2386 (Pt-I)	Method of test for aggregate for concrete (Particle size and shape)
14	IS 2386 (Pt-II)	-Do- Estimation of deleterious materials and organic Impurities.
15	IS 2386 (Pt-III)	-Do- Specific gravity, density, voids, absorption and Bulking.
16	IS 3025	Method of sampling and test for water
17	IS 3406	Specification for masonry cement.
18	IS 3812 (Part I)	Specification for fly ash for use as pozzolana in cement Mortar and concrete
19	IS 3812 (Part II)	Specification for fly ash for use as admixture in cement Mortar and concrete
20	IS 4031 (Part I) to (Part XIII)	Method of Physical test for hydraulic cement
21	IS 4032	Method of chemical analysis of Hydraulic cement.
22	IS 8041	Rapid hardening Portland cement.
23	IS 8042	Specification for white cement
24	IS 8043	Hydrophobic Portland cement
25	IS 8112	Specification for 43 grade ordinary Portland cement
26	IS 11652	Woven HDPE sacks for packing cement
27	IS 11653	Woven polypropylene sacks for packing cement
28	IS 12174	Jute synthetic union bags for packing cement

3.0 MORTARS

3.0 GENERAL

Desirable properties of mortars for use in masonry are:

(a) Workability
(b) Water retentivity
(c) Rate of stiffing
(d) Strength
(e) Resistance to rain penetration
(f) Durability

3.1 MATERIALS

3.1.1 Water

3.1.1.1 Water used for mixing and curing shall be clean and free from injurious quantities of alkalies, acids, oils, salts, sugar, organic materials, vegetable growth or other substance that may be deleterious to bricks, stone, concrete or steel. Potable water is generally considered satisfactory for mixing. The Ph value of water shall be not less than 6. The following concentrations represent the maximum permissible values: (of deleterious materials in water). STP water also can be used on works subject to clearance on test results.

(a) ***Limits of Acidity:*** To neutralize 100ml sample of water, using phenolphthalein as an indicator, it should not require more than 5ml of 0.02 normal NaOH. The details of test shall be as given in IS 3025 (part 22).

(b) ***Limits of Alkalinity:*** To neutralize 100ml sample of water, using mixed indicator, it should not require more than 25ml of 0.02 normal H_2SO_4. The details of tests shall be as given in IS 3025 (part 23).

(c) ***Percentage of Solids:*** Maximum permissible limits of solids when tested in accordance with IS 3025 shall be as under:

Organic	200mg/ liter
Inorganic	3000 mg/ liter
Sulphates	400 mg/ liter

Chlorides	2000 mg/ litre.for concrete not containing embedded steel and 500 mg./ltr. For reinforced concrete work.
Suspended matter	2000 mg/ liter

The physical and chemical properties of ground water shall be tested along with soil investigation and if the water is not found conforming to the requirements of IS 456-2000, the tender documents shall clearly specify that the contractor has to arrange good quality water for construction indicating the source.

3.1.1.2 Water found satisfactory for mixing is also suitable for curing. However, water used for curing shall not produce any objectionable stain or unsightly deposit on the surface.
3.1.1.3 Sea water shall not be used for mixing or curing
3.1.1.4 Water from each source shall be tested before the commencement of the work and thereafter once in every three months till the completion of the work. In case of ground water, testing shall also be done for different points of drawdown. Water from each source shall be got tested during the dry season before monsoon and again after monsoon.

3.1.2 Cement
3.1.2.1 The cement used shall be any of the following grade and the type selected should be appropriate for the intended use.

(a) 33 grade ordinary Portland cement conforming to IS 269.
(b) 43 grade ordinary Portland cement conforming to IS 8112.
(c) 53 grade ordinary Portland cement conforming to IS 12269.
(d) Rapid hardening Portland cement conforming to IS 8041.
(e) Portland slag cement conforming to IS 455.
(f) Portland Pozzolana cement (fly ash based) conforming to IS 1489 (Part 1).
(g) Portland Pozzolona cement (calcined clay based) conforming to IS 1489 (part 2).
(h) Hydrophobic cement conforming to IS 8043
(i) Low heat Portland cement conforming to IS 12600.
(j) Sulphate resisting Portland cement conforming to IS 12330
(k) White cement conforming to IS 8042

Different types of cement shall not be mixed together. In case more than one type of cement is used in any work, a record shall be kept showing the location and the types of cement used.

3.1.2.2 ***Caution in Use of Cement Grade 53 in Construction:*** Because of the faster hydration process, the concrete releases heat of hydration at a much faster rate initially and release of heat is the higher in case of Grade. 53. The heat of hydration being higher, the chances of micro-cracking of concrete is much greater. Thus, during initial setting period of concrete, the higher heat of hydration can lead to damaging micro-cracking within the concrete which may not be visible at surface. This cracking is different from shrinkage cracks which occurs due to faster drying of concrete in windy conditions.

The situation can be worse when we tend to increase the quantity of the cement in the concrete with a belief that such increases are better for both strength and durability of concrete. Thus, it is very essential to be forewarned that higher grade cement specially grade 53 should be used only where such use is warranted for making higher strength concrete and also where good Quality Assurance measures are in place, by which proper precaution are taken to relieve the higher heat of hydration through chilling of aggregates or by proper curing of concrete. There are instances where higher grade cement is being used even for low strength concrete, as, mortar or even for plastering. This can lead to unnecessary cracking of concrete/ surfaces.

Another issue to be cautioned against is the tendency of the manufacturers to project Grade 53 cement as stronger cement, whereas Grade 33 or 43 are enough to produce the concrete of desired characteristic strength. The scenario of method of production of cement by various manufacturers should also be kept in mind while ordering various grades of cement. The ability to produce cements of particular fineness get fixed by the machinery installed by the manufacturers, and thus the ability to produce other various grades of cement by a particular manufacturer also gets limited. Whereas tendency today is to supply the consumer what he orders for by the manufacturers by simply stamping such grades on the bags. Thus, it is often observed that cement bags marked as grade 33 or 43 may really be containing cements of much higher grade.

3.1.2.3 ***Compressive Strength :*** Compressive strength requirement of each type of cement for various grades when tested in accordance with IS 4031 (part 6) shall be as under:

Sample	**Strength in N/mm2 not less than for**		
Age at testing	Gr. 33	Gr.43	Gr. 53
72 + 1 hr	16	23	27
168 + 2 hrs	22	33	37
672 + 4 hrs	33	43	53

3.1.2.4 ***Setting Time:*** Setting time of cement of any type of any grade when tested by Vicat apparatus method described in IS 4031 shall conform to the following requirement:

(a) Initial setting time: Not less than 30 minutes
(b) Final setting time: Not more than 600 minutes

3.1.2.5 ***Supply :*** The cement shall be packed in jute sacking bags conforming to IS 2580, double hessian bituminized (CRI type) or woven HDPE conforming to IS 11652. Woven polypropylene conforming to IS 11653, jute synthetic union conforming to IS: 12174, or any other approved composite bags, bearing the manufacturer's name or his registered trade mark if any, with grade batch no. and type of cement, with date of manufacturing of batch of cement. Every delivery of cement shall be accompanied by a producer's certificate conforming that the supplied cement conforms to relevant specifications. These certificates shall be endorsed to the Project Manager for his record.

Every consignment of cement must have identification marks on packages indicating date of manufacturing grade and type of cement batch no. etc. Cement brought to works shall not be more than 6 weeks old from the date of manufacture.

Effective precautionary measures shall be taken to eliminate dust-nuisance during loading or transferring cement.

3.1.2.6 ***Stacking and Storage:*** Cement in bags shall be stored and stacked in a shed which is dry, leak-proof and as moisture-proof as possible. Flooring of the shed shall consists of the two layers of dry bricks laid on well consolidated earth to avoid contact of cement bags with the floor. Stacking shall be done about 150 to 200 mm clear above the floor using wooden planks. Cement bags shall be stacked at least 450 mm clear off the walls and in rows of two bags leaving in a space of at least 600 mm between two consecutive rows. In each row the cement bags shall be kept close together so as to reduce air circulation. Stacking shall not be more than 10 bags high to avoid lumping under pressure. In stacks more than 8 bags high, the cement bags shall be arranged in header and stretcher fashion i.e. alternately lengthwise and crosswise so as to tie the stacks together and minimize the danger of toppling over.

A typical arrangement for storing and stacking of cement is shown in Fig. 1. Of sub-head of Carriage of Materials.
Different types of cement shall be stacked and stored separately.
Cement bags shall be stacked in a manner to facilitate their removal and use in the order in which they are received.

For extra safety during monsoon, or when cement is expected to be stored for an unusually long period, each stack shall be completely enclosed by a water proofing membrane, such as polyethylene, which shall cover the top of the stack. Care shall be taken to see that the water proofing membrane is not damaged at any time during use.

Storage of cement at the work site shall be at the contractor's expense and risk. Any damage occurring to cement due to faulty storage in contractor's shed or on account of negligence on his part shall be the liability of the contractor.

3.1.3 Fine Aggregate

3.1.3.1 Aggregate most of which passes through 4.75 mm IS sieve is known as fine aggregate. Fine aggregate shall consist of natural sand, crushed stone sand, crushed gravel sand stone dust or marble dust, fly ash and broken brick (Burnt clay). It shall be hard, durable, chemically inert, clean and free from adherent coatings, organic matter etc. and shall not contain any appreciable amount of clay balls or pellets and harmful impurities e.g. iron pyrites, alkalies, salts, coal, mica, shale or similar laminated materials in such form or in such quantities as to cause corrosion of metal or affect adversely the hardening, the strength, the durability or the appearance of mortar, plaster or concrete. The sum of the percentages of all deleterious material shall not exceed 5%. Fine aggregate must be checked for organic impurities such as decayed vegetation humps, coal dust etc. in accordance with the procedure prescribed in Appendix 'A' of Chapter 3.

3.1.3.2 ***Silt Content:*** The maximum quantity of silt in sand as determined by the method prescribed in Appendix 'C' of Chapter 3 shall not exceed 8%.

Fine aggregate containing more than allowable percentage of silt shall be washed as many times as directed by Project Manager so as to bring the silt content within allowable limits for which nothing extra shall be paid.

3.1.3.3 ***Grading:*** On the basis of particle size, fine aggregate is graded in to four zones. The grading when determined in accordance with the procedure prescribed in Appendix 'B' of Chapter 3 shall be within the limits given in Table 3.1 below. Where the grading falls outside the limits of any particular grading zone of sieves, other than 600 micron IS sieve, by a total amount not exceeding 5 per cent, it shall be regarded as falling within that grading zone.

TABLE 3.1
Fine Aggregates

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

Note 1: For crushed stone sands, the permissible limit on 150 micron sieve is increased to 20 per cent. This does not affect the 5 per cent allowance permitted in 3.1.3.4 (e) (1) applying to other sieves.

Note 2: Allowance of 5% permitted in 3.1.3.4 (e) (1) can be split up, for example it could be 1% on each of three sieves and 2% on another or 4% on one sieve and 1% on another.

Note 3: Fine aggregate conforming to Grading Zone IV shall not be used in reinforced cement concrete unless tests have been made to ascertain the suitability of proposed mix proportions.

Note 4: Sand requiring use for mortar for plaster work shall conform to IS 1542 and for masonry work shall conform to IS 2116.

3.1.3.4 Type and grading of fine aggregate to be used shall be specified. It shall be coarse sand, fine sand, stone dust or marble dust, fly ash and surkhi. Use of sea sand shall not be allowed, unless otherwise specified.

(a) Coarse sand shall be either river sand or pit sand or a combination of the two. It shall be clean, sharp, angular, gritty to touch and composed of hard silicious material. Its grading shall fall within the limits of grading zone I, II, III of Table 3.1. Grading of sand shall conform to IS 2116 for use in Masonry work.

(b) Fine sand shall be either river sand or pit sand or a combination of the two. Its grading shall fall within the limits of Grading zone IV of Table 3.1. Grading of sand shall conform to IS 1542 for use in plaster work.

(c) Stone dust shall be obtained by crushing hard stones or gravel. Its grading shall fall within the limits of grading Zone, I, II, or III of Table 3.1.

(d) Marble dust shall be obtained by crushing marble. Its grading shall fall within the limits of Grading Zone IV of Table 3.1. Grading of Marble dust for use in Mortar shall be as per following table.

Grading of Marble Dust

IS Sieve	*Percentage Passing*
10 mm	100
4.75 mm	95-100
2.36 mm	95-100
1.18 mm	90-100
600 micron	80-100
300 micron	15-50
150 micron	0-15

(e) *Sand for Masonry Mortar and for Plaster*- Sand shall consist of natural sand, crushed stone sand or crushed gravel sand or a combination of any of these. Sand shall be hard durable, clean and free from adherent coating and organic matter and shall not contain the amount of clay, silt and fine dust more than specified as under.

Deleterious Material: Sand shall not contain any harmful impurities such as iron, pyrites, alkalis, salts, coal or other organic impurities, mica, shale or similar laminated materials, soft fragments, sea shale in such form or in such quantities as to affect adversely the hardening, strength or durability of the mortar.

The maximum quantities of clay, fine silt, fine dust and organic impurities in the sand / Marble dust shall not exceed the following limits:

(1)	Clay, fine silt and fine dust when Determined in accordance within IS 2386 (Part II). In natural sand or crushed Gravel sand & crushed stone sand	not more than 5% by mass
(2)	Organic impurities when determined in Accordance with IS 2386 (Part II)	Color of the liquid shall be lighter than that indicated by the standard specified In IS 2386 (Part II).

Grading of sand for use in masonry mortar shall be conforming to IS 216 (Table 3.2 below).

Grading of sand for use in plaster shall be conforming to IS 1542 (Table 3.2 below):

TABLE 3.2
Grading of Sand for use in Masonry Mortar and Plaster

Grading of sand for use in masonry mortar		*Grading of sand for use in plaster*	
IS Sieve Designation	*Percentage passing by mass*	*IS Sieve Designation*	*Percentage passing by mass*
10 mm	100	10 mm	100
4.75 mm	100	4.75 mm	95 to 100
2.36 mm	90 to 100	2.36 mm	95 to 100
1.18 mm	70 to 100	1.18 mm	90 to 100
600 micron	40 to 100	600 micron	80 to 100
300 micron	5 to 70	300 micron	20 to 65
150 micron	0 to 15	150 micron	0 to 50

Note: For crushed stone sands, the permissible limit on 150 micron IS Sieve is increased to 20%, this Does not affect the 5% allowance as per IS 2386 (Part 1).

3.1.3.5 ***Bulking****:* Fine aggregate, when dry or saturated, has almost the same Volume but dampness causes increase in volume. In case fine aggregate is damp at the time of proportioning the ingredients for mortar or concrete, its quantity shall be increased suitably to allow for bulkage, which shall be determined by the method prescribed in Appendix 'D' of Chapter 3.0 Table 3.3 gives the relation between moisture content and percentage of bulking for guidance only.

TABLE 3.3

Moisture content % age	*Bulking % age (by volume)*
2	15
3	20
4	25
5	30

3.1.3.6 ***Stacking:*** Fine aggregate shall be so stacked as to prevent dust and foreign matter getting mixed up with it as far as practically possible. Marble dust in dry condition shall be collected in bags and properly staked so as not to form lumps, suitable arrangements shall be made to protect it from moisture similar to those adopted for stacking of cement bags.

3.1.3.7 ***Measurements:*** As the fine aggregate bulks to a substantial extent when partially wet, measurements shall be taken when the stacks are dry or appropriate allowance made for bulking.

3.1.4 Broken Brick (Burnt Clay) Fine Aggregate

3.1.4.1 Broken Brick (Burnt Clay) Fine Aggregate, also known as Surkhi, shall be made by grinding well burnt (but not under or over burnt) broken bricks as specified in IS 3068-1986. It shall not contain any harmful impurities, such as iron pyrites, salts, coal, mica, shale or similar laminated or other materials in such form of quantity as to adversely affect hardening, strength, durability or appearance of the mortar.

The maximum quantities of clay, fine silt, fine dust and organic impurities in surkhi (all taken together) shall not exceed five per cent by weight. The particle size grading of surkhi for use in lime mortars shall be within the limits specified in Table 3.4.

TABLE 3.4

IS Sieve Designation	*Percentage passing (by wt)*
4.75 mm	100
2.36 mm	90-100
1.18 mm	70-100
600 microns	40-100
300 microns	5-70
150 microns	0-15

3.1.4.2 ***Stacking:*** Surkhi shall be stacked on a hard surface or platform so as to prevent the admixture of clay, dust, vegetation and other foreign matter. It shall be also protected from rain and dampness and kept under adequate coverings.

3.1.4.3 ***Measurements:*** Surkhi shall be measured in regular stacks in cubic meters. Alternatively it may be measured by weight when supplied in bags.

3.1.5 Fly Ash

Fly ash is finely divided residue resulting from the combustion of pulverized coal in boilers. Fly ash is the pulverized fuel ash extracted from the flue gases by any suitable process such as cyclone separation or electrostatic precipitation. The ash collected from the bottom of boilers is termed as bottom ash. Fly ash is finer than bottom ash. Siliceous fly ash (ASTM Class F) containing calcium oxide less than 10% by mass is normally produced from burning anthracite or bituminous coal and possesses pozzolanic properties. Calcareous fly ash (ASTM Class C) is produced by burning lignite or sub-bituminous coal and contains calcium Exide more than 10% by mass; the content could be as high as 25%. This fly ash has both hydraulic and pozzolanic properties. It shall be clean and free from any contamination of bottom ash, grit or small pieces of pebbles. It is obligatory

on the part of supplier/ manufacture that the fly ash conforms to the requirements if mutually agreed upon & shall furnish a certificate to this effect to the purchaser or his representative.

3.1.5.1 ***Characteristics:*** The physical requirements of fly-ash shall be as specified in Annexure 'E' of Chapter 3. The chemical properties of fly ash shall be as per IS 3812 (part 1 & 2) depending on the usage.

3.1.5.2 ***Stacking:*** Fly ash shall be protected from dirt collecting on it.

3.1.5.3 ***Measurements:*** Fly ash shall be measured in regular stacks in cubic meters. Alternatively it may be measured by weight when supplied in bags.

3.2 PREPARTATION OF MORTARS AND ITS GRADE

3.2.0 Grade of Masonry Mortar

The grade of masonry mortar will be defined by its compressive strength in N/mm2 at the age of 28 days as determined by the standard procedure detailed in IS 2250.

3.2.0.1 For proportioning the ingredients by volume, the conversion of weight into volume shall be made on the following basis:

(a)	Burnt Clay Pozzolana	860 Kg/cum
(b)	Coarse Sand (dry)	1280 kg/cum
(c)	Fine sand (dry)	1600 kg/ cum
(d)	Fly Ash	590 kg/ cum

For details of grades and criteria for selection of Masonry mortars see Appendix 'F'

3.2.1 Cement Mortar

3.2.1.1 This shall be prepared by mixing cement and sand with or without the addition of pozzolana in specified proportions as per Appendix 'F'.

3.2.1.2 ***Proportioning:*** Proportioning on weight basis shall be preferred taking into account specific gravity of sand and moisture content. Boxes of suitable size shall be prepared to facilitate proportioning on weight basis. Cement bag weighting 50 kg shall be taken as 0.035 cubic meter. Other ingredients in specified proportion shall be measured using boxes of size 40 x 35 x 25 cm. Sand shall be measured on the basis of its dry volume in the case of volumetric proportioning.

3.2.1.3 ***Mixing***

3.2.1.3.1 The mixing of mortar shall be done in mechanical mixers operated manually or by power as decided by Project Manager. The Project Manager may, however, permit hand mixing at his discretion taking into account the nature, magnitude and location of the work and practicability of the use of mechanical mixers or where item involving small quantities are to be done or if in his opinion the use of mechanical mixer is not feasible. In cases, where mechanical mixers are not to be used, the contractor shall take permission of the Project Manager in writing before the commencement of the work.

(a) **Mechanical Mixing***:* Cement and sand in the specified proportions shall be mixed dry thoroughly in a mixer. Water shall then be added gradually and wet mixing continued for at least three minutes. Only the required quantity of water shall be added which will produce mortar of workable consistency but not stiff paste. Only the quantity of mortar, which can be used within 30 minutes of its mixing, shall be prepared at a time. Mixer shall be cleaned with water each time before suspending the work.

(b) **Hand Mixing:** The measured quantity of sand shall be leveled on a clean masonry platform and cement bags emptied on top. The cement and sand shall be thoroughly mixed dry by being turned over and over, backwards and forwards, several times till the mixture is of a uniform color. The quantity of dry mix which can be used within 30 minutes shall then be mixed in a masonry trough with just sufficient quantity of water to bring the mortar to a stiff paste of necessary working consistency.

3.2.1.4 ***Precautions:*** mortar shall be used as soon as possible after mixing and before it begins to set, and in any case within half hour, after the water is added to the dry mixture.

3.2.2 Cement Fly ash Sand Mortar

3.2.2.1 This shall be prepared by mixing cement, fly ash and sand in specified proportions as per Appendix G. Mixing shall be done in a mechanical mixer (operated manually or by power) unless otherwise permitted by the Project Manager in writing. The Project Manager may, however, permit hand mixing at his discretion, taking into account the nature, magnitude and location of the work and practicability of the use of mechanical mixer or where items involving small quantities are to be done or if in his opinion the use of mechanical mixer is not feasible. In case, where mechanical mixer is not to be used, the contractor shall take permission of the Project Manager in writing before the commencement of the work.

3.2.2.2 ***Proportioning:*** Proportioning on weight basis shall be preferred taking into account specific gravity of Fly Ash, sand and moisture content. Boxes of suitable size shall be prepared to facilitate proportioning on weight basis. Cement bag weighting 50 kg shall be taken as 0.035 cubic meter. Other ingredients in the specified proportions shall be measured using boxes of suitable sizes. Sand and fly ash shall be measured on the basis of their dry volume in the case of volumetric proportioning.

3.2.2.3 ***Mixing***

(a) *Mechanical Mixing:* Sand and fly ash in the specified proportions shall be mixed dry in a mixer and then the specified quantity of cement shall be added and mixed dry thoroughly. Water shall then be added gradually and wet mixing continued for at least one minute. Water shall be just sufficient to bring the mortar to the consistency of a workable paste. Only the quantity of mortar which can be used within 30 minutes of its mixing shall be prepared at a time.

(b) *Hand Mixing:* The measured quantity of sand and fly ash shall be mixed dry on a clean masonry platform before adding specified quantity of cement to it. The resulting mixture of cement, sand and fly ash shall then be mixed thoroughly being turned over and over, backward several times till the mixture is of a uniform color. The quantity of dry mix which can be used within 30 minutes shall then be mixed in a clean watertight masonry trough with just sufficient quantity of water, to bring the mortar to a stiff paste of necessary working consistency.

3.2.2.4 ***Precautions:*** Shall be same as specified in 3.2.1.4.

APPENDIX 'A'

TEST FOR ORGANIC IMPURITIES

The aggregate must also be checked for organic impurities such as decayed vegetation humus, coal dust etc.

What is called the color test is reliable indicator of the presence of harmful organic matter in aggregate, except in the area where there are deposits of lignite.

Fill a 350 ml clear glass medicine bottle up to 70 ml mark with a 3% solution of caustic soda or sodium hydroxide. The sand is next added gradually until the volume measured by the sandy layer is 125 ml. The volume is then made up to 200 ml by addition of more of solution. The bottle is then stoppered and shaken vigorously and allowed to stand for 24 hours. At the end of this period, the color of the liquid will indicate whether the sand contains a dangerous amount of matter. A colorless liquid indicates clean sand free from organic matter. A straw colored solution indicates some organic matter but not enough to be seriously objectionable. Darker color means that the sand contains injurious amounts and should not be used unless it is washed, and a retest shows that it is satisfactory.

Add 2.5 ml of two per cent solution of tannic acid in 10 per cent alcohol, to 97.5 ml of three per cent sodium hydroxide solution. Place in a 350 ml bottle, fix the stopper, shake vigorously and allow to stand for 24 hours before comparison with the solution above the sand.

Note: A three per cent solution of caustic soda is made by dissolving 3 g of sodium hydroxide in 100 ml of water, preferably distilled. The solution should be kept in a glass of bottle tightly closed with a rubber stopper. Handling sodium hydroxide with moist hands may result in serious burns. Care should be taken not to spill the solution for it is highly injurious to clothing, leather, and other materials.

APPENDIX 'B'

TEST FOR PARTICLE SIZE (SIEVE ANALYSIS)

Apparatus: Perforated plate sieves of designation 10 mm, 4.75 mm and fine mesh sieve of designation 2.36 mm, 1.18 mm, 600 micron, 300 micron and 150 micron should be used.

The balance or scale shall be such that it is readable and accurate to 0.1 per cent of the weight of the test sample.

Sample: The weight of sample available shall not be less than the weight given in the table below. The sample of sieving shall be prepared from the larger sample either by quartering or by means of a sample divider.

TABLE SHOWING MINIMUM WEIGHTS FOR SAMPLING

Maximum size present in substantial proportions (mm)	Minimum weight of sample for sieving (Kg)
10	0.5
4.75	0.2
2.36	0.1

Test Procedure: The sample shall be brought to an air-dry condition before weighing and sieving. This may be achieved either by drying at room temperature or by heating at a temperature of 100 degree to 110 degree centigrade. The air dry sample shall be weighed and sieved successively on the appropriate sieves starting with the largest. Care shall be taken to ensure that the sieves are clean before use.

Each sieve shall be shaken separately over a clean tray until not more than a trace passes, but in any case for a period of not less than two minutes. The shaking shall be done with a varied motion, backwards and forwards, left to right, circular clockwise and anti-clockwise, and with frequent jarring, so that the material is kept moving over the sieve surface in frequently changing directions. Materials shall not be forced through the sieve by hand pressure, but on sieves coarser than 20 mm, placing of particles is permitted, Lumps of fine material, if present may be broken by gentle pressure with fingers against the side of the sieve. Light brushing of underside of the sieve with a soft brush may be used to clear the sieve openings.

Light brushing with a fine camel hair brush may be used on the 150 micron IS sieve to prevent segregation of powder and blinding of apertures. Stiff or worn out brushes shall not be used for this purpose and pressure shall not be applied to the surface of the sieve to force particles through the mesh.
On completion of sieving the material retained on each sieve, together with any material cleaned from the mesh, shall be weighed.

Reporting of Results: The results shall be calculated and reported as:

(a) The cumulative percentage by weight of the total sample passing each of the sieves, to the nearest whole number:
Or
(b) The percentage by weight of the total sample passing one sieve and retained on the next smaller sieve, to the nearest 0.1 percent.

APPENDIX 'C'

TEST FOR SILT CONTENT

The sand shall not contain more than 8% of silt as determined by field test with measuring cylinder.

The method of determining silt contents by field test is given below:

A sample of sand to be tested shall be placed without drying in a 200 ml measuring cylinder. The volume of the sample shall be such that it fills the cylinder up to 100 ml mark

Clean water shall be added up to 150 ml mark. Dissolve a little salt in the water in the proportion one tea spoon to half a liter. The mixture shall be shaken vigorously, the last few shakes being sidewise direction to level off the sand and the contents allowed to settle for three hours.

The height of the silt visible as settled layer above the sand shall be expressed as a percentage of the height of sand below. The sand containing more than the above allowable percentage of silt, shall be washed so as to bring the silt contents within allowable limits.

APPENDIX 'D'

BULKING OF FINE AGGREGATES/SAND (FIELD METHODS)

Two methods are suggested for determining the bulking of sand/fine aggregate. The procedure may be suitably varied, if necessary. Both depend on the fact that the volume of inundated sand/fine aggregate is the same if the sand/fine aggregate were dry.

Method -1: Put sufficient quantity of sand loosely into a container until it is about two-third full. Level off the top of the sand and push a steel rule vertically down through the sand at the middle to bottom, measure the height. Suppose this is 'X' cm.

Empty the sand out of the container into another container where none of it is lost. Half fill the first container with water. Put back about half the sand and rod it with a steel rod, about 6 mm in diameter, so that its volume is reduced to a minimum. Then add the remainder and level the top surface of the inundated sand. Measure its depth at the middle with the steel rule. Suppose this is 'Y' cm.
The percentage of bulking of the sand due to moisture shall be calculated from the formula:
Percentage bulking = (X/Y -1) X 100

Method-2: In a 250 ml measuring cylinder, pour the damp sand, consolidate it by staking until it reached the 200 ml mark.

Then fill the cylinder with the water and stir the sand well (the water shall be sufficient to submerge the sand completely). It will be seen that the sand surface is now below its original level. Suppose the surface is at the mark of Yml, the percentage of bulking of sand due to moisture shall be calculated from the formula.

Percentage bulking= (200/Y – 1) x 100

APPENDIX 'E'

PHYSICAL REQUIREMENTS OF FLY ASH

Sl. No	***Characteristics***	***Requirement of Fly Ash***	
		For use as Pozzolana	***For use as Admixture in Cement Mortar and concrete***
1	*2*	*3*	*4*
(i)	Fineness- Specific surface in m2/kg by Blaine's permeability method, min	320	200
(ii)	Lime reactivity – average compressive strength in N/mm2 Min	4.5	-
(iii)	Compressive strength at 28 days in N/ mm2	Not less than 80 per cent of the strength of corresponding mortar cubes.	-
(iv)	Soundness of autoclave test expansion of specimens, per cent, max	0.8	0.8
(v)	Particles retained on 45 micron IS sieve (wet sieving) in percent maximum	34	

APPENDIX 'F'

CRITERIA FOR SELECTION OF MASONRY MORTARS

(a) The selection of masonry mortars from durability consideration will have to cover both the loading and exposure condition of the masonry. The masonry mortar shall generally be as specified below in (b) to (g).

(b) In case of masonry exposed frequent to rain and where there is further protection by way of plastering or rendering or other finishes, the grade of mortar shall not be less than 0.7 MM but shall preferably be of grade MM2. Where no protection is provided, the grade of mortar for external wall shall not be less than MM2.

(c) In case of load bearing internal walls, the grade of mortar shall preferably be MM 0.702 or more for high durability but in no case less than MM 0.5.

(d) In the case of masonry work in foundations laid below damp proof course, the grade of mortar for use in masonry shall be as specified below.

(i) Where soil has little moisture, masonry mortar of grade not less than MM 0.7 shall be used.

(ii) Where soil is very damp, masonry mortar of grade preferably MM 2 or more shall be used. But in no case shall the grade of mortar be less than MM 2.

(e) For masonry in building subject to vibration of machinery, the grade of mortar shall not be less than MM 3.

(f) For parapets, where the height is greater than thrice the thickness, the grade of masonry mortar shall not be less than MM3. In case of low parapets the grade of mortar shall be the same as used in the wall masonry.

(g) The grade of mortar for bedding joints in masonry with large concrete blocks shall not be less than MM 3.

(h) The compressive strength shall be determined in accordance with the procedure given in IS 2250.

(i) While mixing the pozzolanic material like fly ash in mortars Ordinary Portland cement only shall be use.

Grade of Masonry Mortar (IS 2250)

Sl. No.	***Grade***	***Compressive strength at 28 days in N/mm2***	***Cement***	***Pozzolana (Fly Ash)***	***Sand***
1 2	MM 0.7	0.7 to 1.5	1 1	--- 0.4*	8 10
3 4	MM 1.5	1.5 to 2.0	1 1	--- 0.4*	7 8.75
5 6 7	MM 3	3.0 to 5.0	1 1** 1	---- 0.21 0.4*	6 4.2 7.5
8 9 10	MM 5	5.0 to 7.5	1 1 1	---- 0.4 0.4	5 6.25 5
11 12 13 14	MM 7.5	7.5 & above	1 1** 1 1	---- 0.2* --- 0.4	4 2.1 3 3.75

Note:
* Pozzolana of minimum lime reactivity of 4 N/MM2
** This ratio by volume correspondence approximately to cement pozzolana ratio of 0.8:0.2 by weight. In this case, only ordinary Portland cement is to be used (see IS 269). Specifications for ordinary rapid hardening and low heat Portland cement (Third revision).

Note: Compressive strength shall be determined in accordance with the Appendix –A-IS 2550.

Mortar for Masonry Works

Base concrete on which the slabs are to be laid shall be cleaned, wetted and mopped. The bedding for the slabs shall be with cement mortar 1:5 (1 cement: 5 coarse sand) or as given in the description of the item.

Sl. No. Masonry Type Mortar Grade

1	Stone Masonry 1:6	(1 cement: 6 coarse sand)	
2	Brick Masonry		
	230 thick	1:6	(1 cement: 6 coarse sand)
	115 thick	1:4	(1 cement: 4 coarse sand)
3	Block Masonry		
	200 thick	1:6	(1 cement: 6 coarse sand)
	150 thick	1:4	(1 cement: 4 coarse sand)
	100 thick	1:4	(1 cement : 4 coarse sand)

Mortar for flooring Works

Base concrete on which the slabs are to be laid shall be cleaned, wetted and mopped. The bedding for the slabs shall be with cement mortar 1:5 (1 cement: 5 coarse sand) or as given in the description of the item.

Sl. No.	Flooring / Wall Tile		Mortar Grade	Minimum Thickness
1	Natural Stone	1:4	(1 cement: 4 coarse sand)	20mm
2	Ceramic Tile	1:3	(1 cement: 3 coarse sand)	12mm
3	Vitrified Tile	1:4	(1 cement: 4 coarse sand)	12mm

The average thickness of the bedding mortar under the slabs shall be 20 mm and the thickness at any place under the slabs shall not be less than 12 mm.

Mortar for Plastering Works

The mortar of the specified mix using the type of sand described in the item shall be used. It shall be as specified in Subhead 3.0. For external work and under coat work, the fine aggregate shall conform to grading IV. For finishing coat work the fine aggregate conforming to grading zone V shall be used.

Sl. No.	Location	Type	Mortar Grade
1	Masonry Wall		
	Internal	With lime rendering	1:4 (1 cement: 4 Fine sand)
	External (In Two Coat)	Without Lime rendering	1:3 (1 cement: 3 Fine sand) Base Coat 1:4 (1 cement : 4 Fine sand) Top Coat
	Water Proof plaster		1:3 (1 cement : 3 Fine sand)
2	Concrete Wall		
	Internal	With / without lime rendering	1:3 (1 cement : 3 Fine sand)
	External (In Two Coat)	Without Lime rendering	1:3 (1 cement: 3 Fine sand) Base Coat 1:4 (1 cement : 4 Fine sand) Top Coat
	Water Proofing		1:3 (1 cement : 3 Fine sand)
	Ceiling	With / without lime rendering	1:3 (1 cement : 3 Fine sand)

I) EARTHWORK

1.0 Scope : (Applicable for all Items of work as per BOQ Ref Item No IV (10)

This part of the specification deals with general requirements for earthwork in excavation in different materials, site grading, filling in area shown in drawings, filling back around foundations, plinths and approach ramps, conveyance and disposal of excavated soil and stacking them properly as shown on the drawings or as directed by the Engineer and all operations covered within the intent and purpose of the specifications. The excavation in rock by Chemical Blasting etc. shall be as per relevant specifications.

General earth work excavation (Mass excavation by mechanical means) in all kinds of soil (except in soft and hard rock soil) for lowering & leveling the ground for Lower Ground formation, for footings, rafts, RCC walls foundations , lift pits, trenches, sump tanks, DG foundations, Drain along Roads, Basement Drain from Existing Ground level (defined as 0.00 level) up to the PCC Bottom level ,including necessary manual excavation for dressing the sides & edges, disposing the surplus earth to a place away from the site not objected by civic authorities, nominal de-watering, shoring, etc., complete. All as per specification, drawing. (Block leveling shall be recorded and approved before start of excavation). Cost to include Carting away of excess earth including loading/unloading, labor,, hire and fuel charges for tools and plants, transportation to dumping yard, etc complete., Notes: 1) Bailing out subsurface/rain water in excavation, 2) providing shoring, shuttering to protect sides of foundation & soil stabilization if required, 3) The excavated earth shall be deposited timely at least 3m away from the excavated area to avoid sliding of the earth back into the excavated area. 4)Rate to include nominal de-watering of surface water including rain water, removal of Slush generated while excavation and keeping the area free of water & keep the surface reasonably dry for laying PCC as per IS 9759 5) Authorized working space shall be considered as per IS 1200. At all levels & heights including leads and lifts etc.., complete and as directed by Engineer in charge. As per IS 3764.

2.0 Applicable Codes:

The provisions of the latest Indian Standards listed below, but not restricted to, form part of these specifications:

IS-783	Code of practice for laying of concrete pipes.
IS-1200	Method of measurement of building and civil engineering works - Part I to VI.
IS-1490	Portland - Pozzolana cement
IS-2720	Methods of test for soils. (All Parts)
IS-2809	Glossary of terms and symbols relating to soil mechanics.
IS-3764	Safety code for excavation work.
IS-4081	Safety code for blasting and related drilling operations
IS-4988	Glossary of terms and classifications of earth moving machinery (all parts).

3.0 Drawings:

The Consultant will furnish drawings wherever in his opinion such drawings are required, to show the areas to be excavated/filled, sequence of priorities etc. The Contractor shall follow such drawings strictly.

4.0 Classification of Earth:

For purpose of earthwork soil shall be classified as under:

Loose/soft soil : Any soil which generally yields to the application of picks and shovels, phawras, rakes or any such ordinary excavating implements or organic soil, gravel, silt sand, turf loam, clay, peat etc. Fall under this category.

Dense/Hard Soil: Any soil, which generally requires the close application of picks, or jumpers or scarifies to loosen it. Stiff clay, gravel and cobble stone etc. Fall under this category. (Note: Cobble stone is the rock fragments usually rounded or semi-rounded having maximum diameter in any one direction between 80 & 300 mm.)

Mud: Mud is a mixture of ordinary soft soil and water in fluid or weak solid state.

Soft/Disintegrated rock: (Not requiring blasting). This shall include the type of rock and boulders, which may be quarried or split with crowbars. Laterite and hard conglomerate also come under this category.

Hard Rock: (Requiring blasting) : This shall include the type of rock or boulder which for quarrying or splitting requires the use of mechanical plant or blasting.
(Note: Boulder is a rock fragment usually rounded by weathering, disintegration and explosion or abrasion by water or ice having a maximum dimension in any direction of more than 600 mm).

Hard Rock : (Requiring blasting but where blasting is prohibited) under this category shall fall hard rocks which though normally require blasting for their removal but blasting is prohibited and excavation has to be done by chiseling, wedging or other suitable method.

5.0 General:

5.1 The Contractor shall furnish all tools, plant, instruments, qualified supervisory staff, labor, materials, any temporary works, consumables and everything necessary, whether or not such items are specifically stated herein, for completion of the job in accordance with the specification requirements.

5.2 The Contractor shall carry out the surveys of the site before excavation and set out properly all lines and establish levels for various works such as earthwork in excavation for grading, foundations, plinth filling, road drains, cable trenches, pipelines, culverts, retaining walls etc. Such surveys shall be carried out taking accurately cross sections of the area perpendicular to the grid lines at intervals determined by the Engineer depending on the ground profiles. These will be checked by the Engineer or his representative and thereafter properly recorded.

5.3 The excavation shall be done to correct lines and levels. This shall include where required, proper shoring to maintain excavation and also the furnishing, erection and maintaining of substantial barricades around excavations and warning lamps at night for safety purposes.

5.4 The rates quoted shall include for dumping of excavated material in regular heaps, bunds, rip rap with regular slopes as directed by the Engineer within the lead specified and leveling the same so as to provide natural drainage. Rock/soil excavation shall be properly stacked as directed by the Engineer. As and more resistant materials, forming the casing on the sides and the top. Rock shall be stacked separately.

6.0 Clearing:

The area to be excavated/filled shall be cleared of all fences, trees, plant logs, stumps, bush, vegetation, rubbish, slush etc. and other objectionable matter. If any roots or stumps of trees are met during excavation, they shall be removed. The material so removed shall be disposed off as directed by the Engineer.

Where earth fill is intended, the area shall be cleared of all matter/materials before filling commences. No separate payment shall be mode for such clearing works.

7.0 Precious Objects, Relics, Objects of Antiquities Etc.

All gold, silver, oil, minerals, archaeological and other findings of importance or other materials of any description and all precious stones, coins, treasure troves, relics, antiquities and similar things which may be found in or upon the site shall be the property of the Employer and the Contractor shall duly preserve the same to the satisfaction of the Engineer and from time to time deliver the same to him.

8.0 Excavation for Structures:

8.1 Description:

Excavation for structures shall consist of removal of materials for the construction of the foundations of bridges, culverts, retaining walls, headwalls, cutoff walls, pipe culverts and other similar structures in accordance with the requirements of this specification and the lines and dimensions shown on the drawings or as indicated by the Engineer. The work shall include construction of the necessary cofferdams and cribs and their subsequent removal; all necessary sheeting, shoring, bracing, draining and pumping; the removal of all logs, stumps, shrubs and other deleterious matter and obstruction necessary for placing the foundations, trimming bottoms of excavation; backfilling, cleaning up the site and disposal of all surplus materials.

8.2 Setting out:

After the site has been cleared as per clause 5 above, the limits of excavation shall be set out true to lines, curves, slopes, grades and sections as shown on the drawings or as directed by the Engineer. The Contractor shall provide all labor, survey instruments and materials such as string, pegs, nails, bamboos, stones, lime, mortar, concrete, etc. Required in connection with the setting out of works and establishment of benchmarks. The Contractor shall be responsible for the maintenance of benchmarks and other marks and stakes as long as they are required for the work in the opinion of the Engineer.

8.3 Excavation :

Excavation shall be taken to the width of the lowest step of footing or the pile caps and the sides shall be left plumb where the nature of the soil allow it. Where the nature of the soil or the depth of excavated trench/pit does not permit vertical sides, the Contractor at his own expense shall put up necessary shoring, strutting and planking or cut slopes to a safe angle or both with due regard to the safety of personnel and the works and to the satisfaction of the Engineer.

The depth to which the excavation is to be carried out shall be as shown on the drawings unless the type of material encountered is such as to require changes, in which case the depth shall be as ordered by the Engineer.

8.3.1 Excavation in all types of soil except rock:

Shall mean excavation in vegetation soil, turf, loam, clay, mud black-cotton soil, earth murrum (hard or soft) shingle and generally any material which requires close application of picks or scarifies to loosen and not affording much resistance to digging.

8.3.2 Excavation in rock not requiring blasting:

Shall mean excavation in limestone, sandstone, laterite, hard conglomerate or other rock, which can be quarried or split with crowbars or, wedges. This shall include unblasted boulders.

8.3.3 Excavation in rock requiring blasting:

Shall mean excavation in hard rock requiring blasting encountered at places of excavations.

The Contractor shall obtain license from District/Public authorities for carrying out blasting work as well for obtaining transporting and storing explosives as per ' Explosives Rules 1940' or as amended. He shall purchase the explosives, fuses, detonators etc. Only from a licensed dealer. He shall maintain the account of explosives etc. Purchased and used by him. He shall be responsible for safe custody and proper accounting of explosive materials. Contractor will be fully responsible for any breach of the aforesaid Act.

Blasting shall normally be done with gunpowder. Dynamite, Gelatin or any other high explosives shall only be used in special cases with written permission of the consultant and District authorities concerned under Explosive Rules'.

Blasting operations shall be carried out under supervision of a responsible representative of the Contractor during certain hours, preferably during lunch break as approved in writing by the Consultant. The representative shall be conversant with the rules of blasting.

Proper precautions for safety of persons shall be taken. Red flags shall be prominently displayed around the area to be blasted and all people on work except those who actually light the fuses shall be withdrawn to safe distance of not less than 100 meters from the blast. Blasting shall not be done within 100 meters of an existing masonry or any other kind of structure unless special precautions are taken by heavy blanketing etc. The Contractor shall be responsible for any damage to the person and/or property either directly or incidental to such blasting including his employees.

Where blasting is not practical or is prohibited, excavation shall be done by wedging or chiseling and it shall be restricted to the quantity required to enable the necessary foundation to be put in. The item also covers bailing out subsoil water or rainwater including pumping at any stage of the work, shoring strutting etc.

8.4 Dewatering and Protection:

Where water is met with in excavation due to stream flow, seepage, springs, rain or other reasons, the Contractor shall take adequate measures such as bailing, pumping, construction of diversion channels, drainage channels, bunds, cofferdams and other necessary works to keep the foundation trenches/pits dry when so required and to keep the green concrete/masonry against damage by erosion or sudden rise of water level. The method to be adopted in this regard and other details thereof shall be left to the choice of the Contractor but subject to the approval of the Engineer. Approval of the Engineer shall, however, not relieve the Contractor of his responsibility for the adequacy of dewatering and protection arrangements and the safety of the works.

Where cofferdams are required, these shall be carried to adequate depths and heights, be safely designed and constructed and be made as watertight as is necessary for facilitating construction to be carried out inside them. The interior dimensions of the cofferdams shall be such as to give sufficient clearance for constructions and inspection and to permit installation of pumping machinery inside the enclosed area.

Pumping from inside of any foundation enclosure shall be done in such a manner as to preclude the possibility for the movement of water through any freshly placed concrete. No pumping shall be permitted during the placing of concrete or for any period of at least 24 hours thereafter, unless it is done from a suitable sump separated from the concrete work by a watertight wall or similar means. At the discretion of the Contractor shall take all precautions in diverting channels and in discharging the drained water so as not to cause damage to the works or to the adjoining property.

8.5 Preparation of Foundation:

The bottom of the foundation shall be leveled both longitudinally and transversally or stepped as directed by the Engineer. Before the footing is laid, the surface shall be slightly watered and rammed. In the event of the excavation having been made deeper than that shown on the drawing or as otherwise ordered by the Engineer, the extra depth shall be made up with concrete or masonry of the foundation grade at the cost of the Contractor. Ordinary filling shall not be used for the purpose to bring the foundation to level.

When rock or other hard strata is encountered, it shall be freed of all loose and soft materials, cleaned and cut to a firm surface either level, stepped, or serrated as directed by the Engineer. All seams shall be cleaned out and filled with cement mortar or grout to the satisfaction of the Engineer.

8.6 Slips and Blows:

If there are any slips or blows in the excavation, these shall be removed by the Contractor at his own cost.

8.7 Backfilling:

To the extent available, selected surplus soil from the excavation shall be used as backfill. Fill materials shall be free from clods, salts, sulfates, organic or other foreign materials. All clods of earth shall be broken or removed. Where excavated material is mostly rock, the boulders shall be broken into pieces not larger than 150 mm size mixed with properly graded fine materials consisting of murrum or earth to fill up the voids and the mixture used for filling.

Back filling / Refilling with excavated good quality and approved earth free from debris for trenches of foundation / footings, retaining wall, above raft, services/other trenches, lift pits, underground structures and elsewhere as directed at site including breaking clods, watering ramming, consolidating and compacting in 150mm thick layers using vibratory compactors, plate compactors, rollers of different capacities and at inaccessible places with wooden/steel rammers to suit site conditions to achieve modified proctor density of 98% at optimum moisture content, all leads and lifts, bailing/pumping out water to keep site dry while back filling. Rate shall include conveyance of materials, labor, machinery etc, complete as per detailed specification.

If any selected fill material is required to be borrowed, the Contractor shall make arrangement for bringing the material from outside borrow pits. The material sources shall be subject to the prior approval of the Engineer. The Contractor shall make necessary access roads to such borrow areas at his own cost, if such access roads do not exist.

The selected fill material shall be approved quality murrum having liquid limit not more than 40 and plasticity index not more than 20 and minimum dry density not less than 1700 kg per cu.m.

Backfilling of the foundation trenches/pits shall be done as soon as the foundation work has been completed to the satisfaction of the engineer and measured but not earlier than the full setting of the concrete or masonry of the foundation. Backfilling shall be carried out in such a manner as not to cause undue thrust on any part of the structure. Backfilling shall be done in space around the foundations after clearing it of all debris and in layers of 150 mm loose thickness, watered and compacted to the satisfaction of the Engineer and up to the original surface. The backfilling material shall be spread with the help of drag spreader, motor grader or other approved means. Moisture content shall be checked and adjusted by sprinkling water so that it is from 1% above to 2% below optimum moisture content. Immediately after rolling with 8-10 ton roller shall be commenced, starting from edge and proceeding towards center, except in super-elevated portion where it shall be commenced from inner edge and progress towards outer edge. Each pass of the roller shall uniformly overlap not less than one third of the track made in preceding pass. During rolling, the grade and camber shall be checked and defects if any shall be rectified by adding or removing fresh materials. Rolling shall continue till the modified proctor dry density is at least 98% of the maximum dry density for the material determined. All loose, segregated or otherwise defective area shall be made good for the full thickness of the layer and recompacted.

8.8 Back filling / refilling with earth brought from out side

Supplying and Back filling good quality / approved earth free from debris for trenches of foundation / footings, retaining wall, above raft, services/other trenches, lift pits, underground structures and elsewhere as directed at site including breaking clods, watering ramming, consolidating and compacting in 150mm thick layers using vibratory compactors, plate compactors, rollers of different capacities and at inaccessible places with wooden/steel rammers to suit site conditions to achieve modified proctor density of 98% at optimum moisture content, all leads and lifts, bailing/pumping out water to keep site dry while back filling. Rate shall include conveyance of materials, labor, machinery etc, complete as per detailed specification.

8.9 Disposal of Surplus Excavated Materials:

All the excavated materials shall be the property of the employer where the excavated material is directed to be used in the construction of the works for the general grading, plinth filling or embankments, the operations shall be arranged in such a manner that the capacity for cutting, haulage and compaction are nearly the same.

All hard materials such as hard murrum, rubble etc. not intended for filling in foundations, plinth or embankments shall be stacked neatly for future use as directed by the Engineer within the lead specified. Unsuitable or surplus materials not intended for use in part of the works or for reuse shall be disposed of as directed by the Engineer.

Removal / Carting away of surplus earth, including removing excavated material from foundations and general excavation and conveying outside the Existing premises and depositing / disposing at IIMB's New campus Site as directed by E-In-Charge, which is about 30KM away from the Existing campus. Measurement will be on the net quantities after deducting for voids. (Truck/trailer measurement less 25% voids)

9.0 Measurement and Rates:

The measurement shall be generally conforming to IS:1200, Part-I unless otherwise specified. Authorized working space shall be considered as per IS 1200 at all levels & heights including leads and lifts etc.., complete and as directed by Engineer in charge. If taken out to a greater width, length or depth than shown or required, the extra work occasioned thereby shall be done at the Contractor's expenses.

The dimensions of the trenches and pits shall be measured correct to the nearest cm. and cubical contents worked out in cubic meters, correct to two places of decimal.

Measurements of filling excavated earth or sand in plinth or under floors: depth of consolidated earth fillings shall be measured for the purpose of payments. The dimensions of the fillings shall be measured correct to the nearest cm. and cubical contents worked out in cubic meters correct to the two places of decimal.

Rate for earthwork shall include the following :

a) Excavation and disposing earth as specified.
b) Setting out works, profiles etc.
c) Site clearance such as cleaning of rank vegetation, shrubs, and brushwood.
d) Forming (or leaving)" dead mean" or "tell tales" and their removals after measurement
e) Bailing out water in excavation from rains, sub-soil water etc.
f) Protection and temporarily supporting of existing services, of pipes, water mains, cables etc. met within the course of excavation. Care shall be taken not to disturb electric and communication cables. Removal of such cables, if necessary, shall be arranged by the Engineer.
g) Forming (or leaving) steps in sides of deep trenches and their removal.

h) Removing slips or falls in excavation.
i) Fencing and/or other suitable measures for protection against risk of accidents as approved by the Engineer.
j) Excavation for insertion of planking, Shoring, Strutting wherever required, and as directed by Engineer in charge.
k) Backfilling the trenches with selected excavated materials.
l) Chiseling / blasting / wedging of rock.
m) Stacking the excavated soft rock / hard rock for measurement.
n) Providing shoring, strutting for 'protecting the sides of the foundation wherever required.
o) The quoted rate shall include for lift and lead outside the campus as per the regulations of local authority.
p) Cost to include all necessary loyalty and other permission charges required to execute the works.
q) Contractor shall take all required permissions from the appropriate authorities for excavation, blasting, carting away materials etc., and shall bear all such expenses.

10.0 Reclamation:

If the work requires the construction of the diaphragm walls, the excavated pits will be filled by material suitable for diaphragm walling work. The materials shall be free of clay, roots, vegetable matter or other injurious matter. Samples of the materials to be used for the filling shall be submitted for approval before use.
The area of the working platform for diaphragm walls will be 5 meters from the outer face of the diaphragm walls and slope of 1:5 will be provided.
Measurements for the reclamation will be restricted to the above limits.

The portion of the reclamation on the outer side of the diaphragm wall which is not a part of the permanent reclamation required and is only for providing working area will be protected and maintained by the Contractor for the period required for the execution of the diaphragm walls.

In the area of the reclamation within the diaphragm wall the fill materials will be placed in layer and compacted in the portion above water level using a roller of not less than 5 tons. In the area beyond the deck slab the reclamation will be topped with a layer of one meter of murrum in case the reclamation is done with sand.

11. Earth filling:

General: Filling shall be done with good earth, murrum, and stone chips or disintegrated building debris. it shall be free from salts, organic matter, black cotton soil or slushed earth and combustible material. All clods shall be broken.

a) Filling in Plinth:

Filling shall be done in layer not exceeding 25 cm, watered and consolidated by ramming with iron or wooden rammers weighing 7 to 8 kg., and having base 20 cm. Square or 20 cm. diameters. When the filling reaches the finished level, surface shall be kept flooded with water for at least 24 hours, allowed to dry and then rammed and consolidated, after making good any settlement in order to avoid settlement at a later stage. Special care shall be taken to pack earth under plinth beams and column corners.

Finished level of filling shall be kept to a slope intended to be given to the floor.

b) Filling in outdoor Position and for Site Development

Shall be done in layer of 30 cm. and each layer shall be adequately watered. When tilling reaches the required level topmost layer shall be dressed to proper section, grade and camber and rolled by 8 to 10 tons. Power roller and adequately watered to aid compaction.

12. Dry Rubble Packing:

Ground shall first be leveled up and thoroughly consolidated by means of heavy log hammer or frog rams. Rubble of specified thickness shall be laid and set with hand. It shall be consolidated either by hand roller or wooden log hammer; free use of water being made during consolidation. All hollows and interstices after consolidation shall be filled with quarry spalls, stone chips, etc. And the packing blinded with stone grit and watered and consolidated by log hammer.

13. Leveling Course:

It shall be either plain cement concrete or leaner mix or lime concrete which shall be proportioned as stipulated in the relevant items and placed in position conforming line and level shown on the drawing and compacted by approved means and cured adequately.

ii) CONCRETE

1. GENERAL: (Applicable for all Items of work as per BOQ Ref Item No IV (4), VI (4) , (11)

These specifications cover the requirements of plain and reinforced cement concrete for use in various components of structures.

For all items of concrete in any portion of structure or its associated works controlled concrete shall be used.

The provisions of the latest revisions of the following I.S.Codes shall form a part of this specifications to the extent they are relevant:

IS-269 Specification for ordinary Rapid Hardening and Low Heat Portland Cement
IS-303 Plywood for General Purpose
IS-383 Specification for Coarse and Fine Aggregates from Natural Source for Concrete.
IS-460 Specification for Test Sieves.
IS-515 Specification for Natural and Manufactured Aggregates for use in Mass Concrete.
IS-516 Methods of Tests for Strength of Concrete.
IS-650 Standard Sand for Testing of Cement.
IS-1199 Sampling and Analysis of Concrete.
IS-1200 Method of Measurement of Building Works.
IS-1542 Sand for Plaster.
IS-1791 Batch Type Concrete Mixers.
IS-2386 Methods of Test for Aggregates for Concrete (8 Parts)
IS-2502 Code of Practice for Bending and fixing of bars for Concrete Reinforcement.
IS-2505 Immersion Type Concrete Vibrators.
IS-2506 Screed Board Concrete Vibrators.
IS-2722 Specification for Portable Wing Weigh Batcher (Single and double bucket type)
IS-2911 Code of Practice for Design and Construction of Pile Foundation.
IS-3366 Pan Vibrators.
IS-3558 Code of Practice for the use of Immersion Vibrators for Consolidating Concrete.
IS-3370 Code of Practice for Concrete Structures for the Storage of Liquids (All Parts)
IS-4656 Form Vibrators for Concrete.
IS-5640 Method of Test for determining Aggregate Impact Value of soft, coarse aggregates.
IS-5816 Method of test for Splitting Tensile Strength of Concrete Cylinder.
IS-6461 Cement Concrete: Glossary of Terms
IS-8043/E Emergency Specifications for Hydrophobic Cement.
IS-8112 Specifications for High Strength Ordinary Portland Cement.
IS-12269 Specifications for 53 Grade Cement.

Other IS Codes pertaining to the items of cement concrete work in structural work and not listed above shall also be deemed to come under the purview of this clause. All Indian Roads Congress Standards, Indian Railway Standards and Specifications and Codes of Practice shall also come under this purview.

2. GRADES OF CONCRETE:

2.1 PLAIN CEMENT CONCRETE WORKS:

Providing & laying **M10 grade** concrete (pump able) with minimum cement content of 220 kg /cum of 53 grade OPC using manufacture sand, 20mm downsize aggregates 100mm thick below footings, Raft, Retaining walls, Sump Tanks, Drains, Trenches, D.G.Foundations, storm water collection sump, Ramp Base, Steps, Below Floors etc. Including base preparation, compaction, levelling, all lead and lifts, curing and shuttering if necessary etc., complete as directed by Engineer in charge.

Providing and laying 50 mm to 100mm thick **M15 grade** concrete with minimum cement content of 240kg/cum of 53 grade OPC using manufacture sand, 20mm and downsize aggregates for sunken areas including base preparation, compaction, curing, shuttering etc., complete at all levels as directed by Engineer in charge.

Providing and laying **M20 grade** concrete with 20mm and downsize aggregates with minimum cement content of 300kg/cum of 53 grade OPC with Admixtures from Fosroc, Dr Fixit(Pedilite), BASF on terraces for an avg thickness of 75 to 100mm as protection screed concrete over waterproof coating laid in panels of 3m x 4m size including control joints of 5mm wide x10mm depth and filling the joints with Poly Sulphide sealant. and finished the top surface smoothly to the required line, levels, slopes and with thread marks at 300 c/c or as directed with required waterproofing compound, and all joints to be treated with water proof grouting including base preparation, compaction, curing, shuttering finishing the coving for min 300mm high on all sides against the parapet walls etc. As directed by Project Manager.

2.2 CONTROLLED CONCRETE:

For controlled concrete, design of the mix shall be arrived at after preliminary tests and in its production all necessary precautions shall be taken to ensure that the required works cube strength is attained and maintained. The controlled concrete shall be in grades designated as M:15, M:20, M:25, M:30, M:40, M:50, M:60, M:70, M:80

M:15 concrete shall be used for all concrete used as Plain Cement Concrete under footings, rafts, bases, flooring on grade, as filling material etc.

M:20, M:25, M:30, M:40, M:50, M:60, M:70, M:80 concrete shall be used for all structural members and in all such work where reinforcement is used.

In the designation of a concrete mix, letter M refers to the mix and the number to the specified 28 days works cube compressive strengths of that mix on 150 mm cubes expressed in N/mm2.

Important notes in regard to reinforced cement concrete.

1. All concrete used for reinforced concrete work (structural concrete) shall be "Controlled concrete"

While quoting for structural concrete work contractors are particularly advised to study the relevant drawings carefully before quoting.

Providing & laying controlled reinforced cement concrete confirming to grades as specified in (IS 456 - 2000) as per specifications using 20mm down size aggregates at any depth or heights excluding the cost of steel reinforcement centering, shuttering, scaffolding but inclusive of cost towards compacting with vibrations, curing and hacking the exposed surfaces wherever required to receive plaster or floated steel troweled surface whenever specified. The rate shall include cover blocks in concrete to keep reinforcement in position made of PVC or Nylon of approved make / quality and arrangements to provide recesses to slabs, columns, walls and placing and securing properly within the formwork sleeves and / or opening in slabs, embedment's such as insert plates, bolts, corner protection angles, anchors etc. (embedment shall be paid separately under respective items), construction joints, sunk slabs, cantilever slabs, making holes or cutting formwork for taking

out Electrical conduits or dowels for column to Block / Brick work etc. to the required shape, size and slope as shown in the drawing.
The rates shall also include account for any admixtures (approved by the consultants) the contractor may use in order to enhance the workability, durability to achieve accelerated strength if required etc. The rate shall include use of plasticizers and retarders to limit the water/cement ratio to 0.45 and the temperature to 25 degree C at the time of setting. Complete care shall be taken to achieve dense and fully watertight concrete. All requirements to pump the concrete to the required places with good rheology shall be considered while quoting.
A qualified mechanic shall always be available during working hours for maintenance of weight batching machines.
The successful tenderer shall maintain at site, cube testing machine in good working order, sieves, slump cone, graduated cylinder and weights, scales for material testing and other relevant lab equipment's as per technical specifications.
Note: Construction joints shall be at pre-approved locations only and shall be vertical or stepped. Concrete shall be chipped immediately after final setting using mechanical chippers and thoroughly cleaned surface shall be given
a. A thick coat of slurry if the joint is less than 3 days old
b. A thick coat of slurry with latex based admixture if the joint is less than 7 days old
c. A coat of epoxy if it is more than 7 days
Construction joints in columns, walls shall be horizontal and all the latent concrete shall be removed after final setting and shall be given a coat of thick slurry if the joint is below the floor level and mortar poured from the top mix proportion equal to that of concrete. Adequate care including necessary formwork shall be taken to cast rich mix around columns if difference in strength specified is 25%
The starter concrete should be thoroughly compacted and shall be green construction joint. The minimum height of the starter should be at least 300mm
Contractor shall submit a scheme and get it approved for all locations of construction joints envisaged.
For all structural concrete elements post construction dimension and levels shall be documented, submitted and shall insisted upon.
Mockup of Exposed Concrete shall be Executed at site as per the architectural drawings and shall be got approved by the Architects prior to start of Exposed concrete works on the project site. The contractor shall also provide a minimum of 3 types of exposed concrete walls of size (2m x 2.4m). No Payment will be made towards Mockup works.
Using RMC in foundations. Upto Ground level.

3. STRENGTH REQUIREMENT OF CONCRETE:

The compressive strength requirements for various grades of concrete controlled as well as ordinary shall be as given in Table 1.

For controlled concrete, the mix shall be so designed as to attain in preliminary tests strength at least 33 percent higher than that required on works tests.

Table 1

Grade of Concrete	**Compressive works test strength in N/sq.mm on 150 mm cubes after tests conducted in Accordance with IS-456.**	
	Min. at 7 days	**Min. at 28 days**
M:15	11	15
M:20	13	20
M:25	18	25
M:30	20	30
M:40	26	40
M:50	34	50
M:60	40	60
M:70	50	70

M:80	56	80

Note: In all cases, the 28 days compressive strength specified in Table 1 shall alone be the criterion for acceptance or rejection of the concrete.

Where the strength of a concrete mix, as indicated by tests, lies in between the strength for any two grades specified in Table 1, such concrete shall be classified for all purposes as a concrete belonging to the lower of the two grades between which its strength lies.

Contolled Smart dynamic concrete (low fine self compacting concrete) of M 30 grade with minimum cementitious content of 360 kg/cum of 53 grade OPC and fly ash or GGBS (limited to 15% by weight of cement) and use of new generation Hyper Plasticizer Master Glenium sky 8600 of BASF or equivalent as per manufacturers specifications in the following items: Note: Quarry dust is not recommended and the total cementitious content can vary if quality of aggregates is vary and contractor to do trails and get it approved before commencement in actual construction.

Vacuum Dewatered Flooring: Providing and laying RCC M25 with Cement content of 320Kg/Cum, Vacuum De-watered Flooring 150mm thick, cost includes 6m x 10mm Grove Cut with Polysulphide Sealant or any other Equivalent Approved Sealant for all Construction joint as per relevant drawing, operation consisting of providing side shuttering to the required levels, Vibrating the concrete by using screed vibrator, and finishing the top surface to required level, Covering the finished concrete surface with 200 micron thick polythene sheet and curing etc., complete. Quoted Cost to include all lift & Lead. Note: Reinforcement shall be measured separately and paid under regular Reinforcement steel item. General Notes: 1. The rates quoted shall include the cost of providing and removing centering formwork and scaffolding wherever required and curing. 2. Gradation of metal for concrete will be as per BIS specifications IS 456.
Providing vacuum dewatered flooring for the flooring concrete of various thickness laid under previous item consisting of providing side shuttering with MS channel , angles, etc; vibrating the concrete by using screed vibrator and dewater-ing by vacuum suction method using approved make equipment and finishing the top surface to required level and grade using power trowels of standard make. Rate to include for covering the finished concrete surface with 200 micron thick polythene sheet and curing.

4. MATERIALS:

4.1 Cement :

All types and brands of cement shall be subject to the approval of the Engineer.

a. Following types of cement shall be used.

i. All cement used for the work shall be 53 grade Portland cement. Portland cement shall comply with the requirements of the latest issue of the IS-12269.

ii. Cement shall be used in the order in which it is received. Cement which has remained in bulk storage at the mill for more than six months, or which has remained in bags in dealer's storage for over three months or which has been stored at project site for more than three months shall be retested before use. Cement shall also be rejected if it fails to conform to any of the requirements of these specifications.

iii. Cement shall be procured from the following brand list:
43/53 Grade OPC Cement - Birla Super, Ultratech, Ambuja, J.K Cement, Coromandel ,Zuari ,ACC.etc.

4.2 Sand :

Natural sand or manufactured sand shall be as follows:

Fine aggregate shall consist of natural sand, manufactured sand or an approved combination thereof and shall conform to IS-383 or 515. The grading zone of sand proposed for use shall be supplied by the Contractor and got approved from the Engineer.

The sand shall be of siliceous material, sharp, hard, strong and durable and shall be free from adherent coating, clay, dust, alkali, organic material, deleterious matter, lumps etc. The sand shall not contain silt more than a total of 2% by weight and shale, clay, silt and other structurally weak particles a total of 5% by weight. Chloride content in washed sand shall not be greater than 0.04% by weight.

Either natural or manufactured sand shall be prepared for use by such screening or washing or both as necessary, to remove all objectionable foreign matter while separating the sand grains to the required size fractions. Natural sand shall be washed, unless specific written authority is given by the Engineer to use sand that meets specification and standards of cleanliness without washing. The sand shall be washed in screw type mechanical washers in potable water to remove excess silt, clay and chlorides. The screening and washing of sand shall be completed at least one day before using it in concrete. The cost of screening and washing must be borne by the Contractor. The fine aggregate shall be taken from a source approved by the Engineer.

4.3 Coarse Aggregate:

Coarse aggregates shall consist of hard, strong, durable particles of crushed stone and shall be free from thin elongated soft pieces, organic or other deleterious matter. It shall have no adherent coating. It will be from a source approved by the Engineer. Only quarries having jaw crushers with choke feeding arrangement production aggregates of nearly cubical shape shall be approved.

Coarse aggregate shall conform to I.S.383 or 515. Aggregates shall be properly screened and if necessary, washed clean before use to remove all vegetables and other perishable substances and objectionable amounts of other foreign matter, the cost of washing and screening being borne by the Contractor.

For heavily reinforced concrete members as in the case of ribs of main beams, nominal maximum size of aggregate shall usually be restricted to 5 mm less than the minimum lateral clear distance between the main bars, or 5 mm less than the minimum cover to the reinforcement, whichever is the smaller. However, if required under special circumstances, the Engineer may permit an aggregate nominal maximum size 25% more than this critical spacing/cover provided that proper vibrating is ensured.

The grading of coarse aggregate shall be such that not more than 5% shall be larger than the maximum size and not more than 10% shall be smaller than the smallest size. Between these sizes the coarse aggregate shall be well graded.

The aggregates shall be subjected to tests in accordance with IS-2386 or as may be directed by the Engineer.

Size of coarse aggregates:

Following shall be the maximum nominal size of coarse aggregate for the different items of works

Table 2
Size of coarse aggregates in different types of works

Item of construction	Maximum nominal size Of course aggregate
RCC well staining concrete, RCC well curb And RCC piles and plum concrete	63 mm
Well cap or pile cap, solid piers, and abutments And wing walls, pier caps and general item of Work in bridge and building construction	40 mm
RCC works in cross girders, deck slab, Wearing course, kerb, light posts, ballast Walls, approach slab etc. and hollow type Piers, abutments, wing walls and pier caps	20 mm
RCC bearings, shells and other thin walled	

Members and in zones of congestion	20 mm
For any other item of construction not Covered by items above	as specified in Drawings or as Desired by the Engineer.

4.4 Fly Ash (pulverized fuel ash) :

Fly ash conforming to Grade 1 of IS3812 may be used as part of replacement of Ordinary Portland Cement provided uniform blending with cement is ensured. However, the proportion of fly ash shall not be more than 25% of the total cementitious content in the given design mix.

4.5 Silica Fume:

Silica fume conforming to a standard approved by the concrete technologist appointed by the Owner may be used as part replacement of cement provided uniform blending with the cement is ensured. The silica fume of very fine non-crystalline silicon dioxide can be used in a proportion of 5 to 10% of the cementitious content of a mix, depending on the requirement of the performance of the concrete.

Silica fume may be furnished as a dry, densified material or as slurry. Silica fumes may be used in slurry form provided appropriate mechanism is available with the concrete producing agency to blend the same with concrete mix. Water cement ratio shall be suitably adjusted to account for the slurry during the process of the design of the concrete mix.

The Contractor shall provide the services of a manufacturer's technical representative, experienced in mixture proportioning, placement procedures, and curing of concrete containing silica fume. The manufacturer's representative shall be available for consultation by the Contractor during mixture proportioning, planning, and production of silica-fume concrete and shall be onsite immediately prior to and during at least the first placement of concrete containing silica fume, and at other times if directed.

4.6 Ground Granulated Blast Furnace Slag:

Ground Granulated Blas Furnace Slab obtained by grinding granulated blast furnace slag conforming to IS 12089 may be used as part replacement of ordinary Portland cement provided uniform blending with cement is ensured.

4.7 Water:

Water used both for mixing and curing shall be free from injurious amounts of deleterious materials. Potable waters are generally considered satisfactory for mixing and curing concrete. Chemical properties of water shall conform to I.S.456.

4.8 Admixtures:

It is essential to use approved Melamine, Naphthalene or PC based admixtures for imparting special characteristics to the concrete, on satisfactory evidence that its use does not in any way adversely affect the properties of concrete, particularly its strength, volume changes, durability and has no deleterious effect on the reinforcement. They should not impair durability of concrete nor combine with the constituent to form harmful compounds. The workability, compressive strength and the slump loss of concrete with and without the use of admixtures shall be established during the trial mixes before the use of the admixtures. Minimum cement quantity shall not be reduced on account of use of admixtures.

The admixtures shall also have the property of set retarding. Before approval of super plasticizer, the Contractor will submit test reports as specified in ASTMC-486 from an approved laboratory as approved by the Engineer in Charge. Subsequent batches will be tested for IR analysis, UV analysis and solid content or any other tests as directed by Engineer in charge.

If two or more admixtures are used simultaneously in the same concrete mix, data should be obtained to assess their interaction and to ensure their compatibility.

Admixture Approvals
Descriptive literature of the grout, air-entraining admixtures, accelerating admixtures, Retarding Admixture, bonding agents, expansive admixtures, surface retarders, water reducing and High Range Water Reducing admixtures, membrane forming curing agents, curing sheets etc. Proposed for use containing certified laboratory test results showing that they meet the approved standards shall be submitted 30 days prior to their use together with a certificate from the manufacturer stating that the products are suitable for the application or exposure for which they are being considered. In addition, a detailed plan shall be submitted for review, showing equipment and procedures for use in mixing and placing the admixtures and agents. All chemical admixtures furnished as liquids shall be in a solution of suitable viscosity for field use as determined by the Engineer in charge.

The admixtures shall not be paid for separately.

4.9 Materials for Repair Work:
The use of approved construction chemicals for bonding between old and fresh concrete and pressure grouting with polymer additives used for repairs shall be must. The selection of the bonding agents and polymer grouts shall be made on written approval of the Engineer. These bonding agents and polymer grouts shall be applied and used in accordance with the instructions of the Manufacturer. The cost of such repair shall be borne by the Contractor. However, it is the Engineer in charge's sole discretion whether the unsatisfactory portion of concreting is to be allowed to be repaired or to order the portion to be demolished to be reconstructed. The cost of the reconstruction will also be borne by the Contractor.

4.10 Storage of Materials:
i. Cement:
The Contractor shall make arrangements to the satisfaction of the Engineer for the storage of cement to prevent deterioration due to moisture and/or intrusion of foreign matter. Bulk cement shall be stored in approved waterproof bin or silo. Bagged cement shall be stored in suitable weather-tight warehouse in a manner to provide easy access for identification and inspection of each consignment. Stored cement shall meet the test requirements as per IS-269 at any time after storage, when a retest is ordered by the Engineer. Each consignment shall be stacked separately with the date of receipt flagged on it, not more than 12 bags stacked in height, the bags being arranged with headers and stretchers. Normally consignments shall be used in the order of receipt at site unless otherwise directed. In the case of large concrete pours, the Engineer will decide on the batch of cement to be used taking into consideration the quantity of cement with particular reference to the concerned concrete pours. Any additional work in handling and storage of cement contingent upon this requirement shall be to the contractor's account and no extra claim will be entertained. Cement shall be protected from exposure to moisture in transit, in storage at the works and until it enters the concrete mixers. The contractor shall keep accurate records of the deliveries of the cement and of its use in the work.

ii. Aggregates:
Coarse and fine aggregates shall be stacked separately in such manner as to prevent contamination by foreign materials. All aggregates shall be stored on concrete or masonry platforms. Each size shall be kept separate with wooden, steel, concrete or masonry bulk-heads, or shall be stored in separate stacks, taking care to prevent the materials at the edges of the stock piles from getting intermixed. Stacks of fine and coarse aggregates shall be kept sufficiently apart. The aggregates shall be stored in easily measurable stacks of suitable heights as may be directed by the Engineer. Fly ash, silica fumes and Ground Granulated Blast Furnace Slag shall have separate silo like containers where intermediate handling is minimized.

4.11 Concrete Blocks:
Concrete blocks to be used in masonry shall be preferably cast and cured on site, the curing to be for seven days immersed completely in water. The mix for the blocks shall be 1:3:6. The aggregates shall be 8 mm downgraded. Minimum crushing strength of these blocks shall be 12 N/mm2. The surfaces of the blocks shall be in one plane, and perfectly perpendicular to adjacent planes. The edges shall be sharp and unbroken at the time of doing the masonry work. The size of the full size blocks shall be as per standard norms and architectural

details. Half or quarter size blocks may be permitted only at the ends of the masonry to be used only as the filling pieces.

5. PROPORTIONING CONCRETE:

5.1 Controlled Concrete:

Concrete mix shall be designed on the basis of preliminary tests. The proportions for ingredients chosen shall be such that concrete has adequate workability for conditions prevailing on the work in question and can be fully compacted.

Except where it can be shown to the satisfaction of the Engineer-in charge that supply of properly graded aggregate of uniform quality can be maintained till the completion of work, grading of aggregate should be controlled by obtaining the coarse aggregate in different sizes and blending them in the right proportions as required. Different sizes, however, shall be stocked in separate stockpiles. Required quantity of material shall be stockpiled several hours, preferable a day, before use. Grading of coarse and fine aggregate shall be checked as frequently as possible, frequency for a given job being determined by the Engineer to ensure that the suppliers are maintaining the uniform grading as approved for samples used in the preliminary tests.

In proportioning concrete, the quantity of both cement and aggregates shall be determined by weight. Water shall either be measured by volume in calibrated tanks or weighed. All measuring equipment shall be maintained in a clean and serviceable condition. Their accuracy shall be periodically checked.

It is most important to keep the specified water-cement ratio constant and at its correct value. To this end, moisture content in both fine and coarse aggregates shall be determined by the Engineer according to the weather conditions. The amount of mixing water shall then be adjusted to compensate for variations in the moisture content. For the determination of moisture content in the aggregates, IS-2386 (Part III) shall be referred to. Suitable adjustments shall also be made in the weights of aggregates to allow for the variation in weight of aggregates due to variation in their moisture content.

TABLE 3

Grade of concrete	Cement content in kg. per cum of concrete
M 15	240
M 20	300
M 25	320
M 30	360
M 35	360 to 420
M 40	380 to 450
M 45 to M 55	400 to 450

Cement content prescribed in the above table is inclusive of additions of fly ash, silica fumes or GGBS. However, the proportions of the individual additional ingredient shall not exceed the limits prescribed for each one in the respective clause.

For concretes above M:60 grade, the proportions of cement, aggregates, admixtures etc. shall be strictly on the basis of experimentation carried out well in advance of commencing the construction. All such experimentation must be recorded in approved formats and will be circulated to structural consultant, site engineers, project managers and engineer in charge representing the Owner.

5.2 Quantity of Water:

The quantity of water shall be just sufficient to produce dense concrete of required workability and strength for the job. An accurate and strict control shall be kept on the quantity of mixing water.

In the case of reinforced concrete work, workability shall be such that the concrete surrounds and properly grips all reinforcement. The degrees of consistency, which shall depend upon the nature of work and methods of vibration of concrete, shall be determined by regular slump tests. Following slump shall be adopted for different types of works.

Type of works	Slumps	
	Where Vibrators Are used	Where Vibrators are not used
Mass concrete in RCC Foundations, footings and Retaining walls	10 to 25 mm	80 mm
Beams, slabs, columns Simply reinforced	25 to 40 mm	100 to 120 mm
Thin RCC section or Section with congested Steel	40 to 50 mm	125 to 150 mm

The values of slump mentioned in the above table are for ordinary compactable or vibrated concrete. Special concretes such as free flow concrete or self-compacting concrete are outside the purview of the above table.

Plasticizers and/or retarders shall be used wherever necessary to control the water cement ratio and to achieve the required slump.

6. MIXING CONCRETE:

6.1 Mixing with Mechanical Mixers:

6.1.1 Stationery Mixers

For all work, concrete, where concrete to be mixed does not exceed 10 co. in one single day, can be mixed in a mechanical mixer which along with other accessories shall be kept in first class working condition and so maintained throughout the construction. Mixing shall be continued till materials are uniformly distributed and uniform color of the entire mass is obtained and each individual particle of the coarse aggregate show complete coating of mortar containing its proportionate amount of cement. In no case shall the mixing be done for less than two minutes after all ingredients have been put into mixer. Hand mixing will not be permitted under any circumstances. Mixers that have been out of use for more than 30 minutes shall be thoroughly cleaned before putting in a new batch. Unless otherwise agreed to by the Engineer, the first batch of concrete from the mixer shall contain only two thirds of the normal quantity of coarse aggregate. Mixing plant shall be thoroughly cleaned before changing from one type of cement to another.

Each mixer shall combine the materials into a uniform mixture and discharge this mixture without segregation. Mixers shall not be charged in excess of the capacity recommended by the manufacturer on the nameplate. Excessive over-mixing requiring introduction of additional water will not be permitted. The mixers shall be maintained in satisfactory operating condition, and mixer drums shall be kept free of hardened concrete. Mixer blades or paddles shall be replaced when worn down more than 10 percent of their depth when compared with the manufacturer's dimension for new blades. Should any mixer at any time produce unsatisfactory results, its use shall be promptly discontinued until it is repaired or replaced.

6.1.2 Mobile or Truck Mixers

The above criteria are also applicable to mobile or truck mixers. A truck mixer may be used for complete mixing (transit-mixed) or to finish the partial mixing done in a stationary mixer. Each truck shall be equipped with two counters from which it shall be possible to determine the number of revolutions at mixing speed and the number of revolutions at agitating speed. Truck mixers shall not be used to mix or agitate concrete with greater than 37.5 mm nominal maximum-size aggregate or concrete with a slump of 50 mm or less. The acceptability of truck mixers shall be determined by consistency tests based on records.

6.1.3 Weigh Batching

All structural concrete shall be weigh batched. All concrete ingredients shall be batched by weight using a weigh batcher of an approved make. (IS: 2722 - Portable Swing Weigh Batchers for Concrete.) Batching shall

be to an accuracy of not less than 1/2 kg and the batcher shall be tested for accuracy of calibration before commencement of the works and at least once a week thereafter or more frequently if so required by the Engineer.

6.2 Mixing with Batching Plants:

Where concrete pours exceed 10 cu.m in a single day, concrete batching plants shall be used to mix concrete. Such batching plants may be erected within or outside the project site.

6.2.1 Capacity

The batching, mixing, conveying, and placing systems shall have a capacity of at least sixty cubic meters per hour or as directed by the Engineer in charge.

6.2.2 Batch Plant

Batch plant shall meet the following requirements.

6.2.2.1 Location

The concrete plant may be located at the site of the work in the general area indicated on the drawings, or may be located offsite.

6.2.2.2 Bins and Silos

Separate bins, compartments, or silos shall be provided for each size or classification of aggregate and for each of the cementitious materials. The compartments shall be of ample size and so constructed that the various materials will be maintained separately under all working conditions. All compartments containing bulk cement, pozzolan, ground granulated blast-furnace slag, or silica fume shall be separated from each other by a free-draining air space. All filling ports shall be clearly marked with a permanent sign stating the contents.

6.2.2.3 Batching Equipment

a. Batchers

Aggregate shall be weighed in separate weigh batchers with individual scales. Bulk cement and/or other cementitious materials shall each be weighed on a separate scale in a separate weigh batcher. Water shall be measured by weight or by volume. If measured by weight, it shall not be weighed cumulatively with another ingredient. Ice shall be measured separately by weight. Admixtures shall be batched separately and shall be batched by weight or by volume in accordance with the manufacturer's recommendations.

b. Water Batcher

A suitable water-measuring and batching device shall be provided that will be capable of measuring and batching the mixing water within the specified tolerances for each batch. The mechanism for delivering water to the mixers shall be free from leakage when the valves are closed. The filling and discharge valves for the water batcher shall be so interlocked that the discharge valve cannot be opened before the filling valve is fully closed. When a water meter is used, a suitable strainer shall be provided ahead of the metering device.

c. Admixture Dispensers

A separate batcher or dispenser shall be provided for each admixture. Each plant shall be equipped with the necessary calibration devices that will permit convenient checking of the accuracy of the dispensed volume of the particular admixture. The batching or dispensing devices shall be capable of repetitively controlling the batching of the admixtures to the accuracy specified. Piping for liquid admixtures shall be free from leaks and properly valved to prevent backflow or siphoning. The dispensing system shall include a device or devices that will detect and indicate the presence or absence of the admixture or provide a convenient means of visually observing the admixture in the process of being batched or discharged.

Each system shall be capable of ready adjustment to permit varying the quantity of admixture to be batched. Each dispenser shall be interlocked with the batching and discharge operations so that each admixture is added separately to the batch in solution in a separate portion of the mixing water or in fine aggregate in a manner to ensure uniform distribution of the admixtures throughout the batch during the required mixing

period. Storage and handling of admixtures shall be in accordance with the manufacturer's recommendations.

d. Moisture Control

The plant shall be capable of ready adjustment to compensate for the varying moisture content of the aggregates and to change the weights of the materials being batched. A moisture meter shall be provided for measurement of moisture in the fine aggregate. The sensing element shall be arranged so that the measurement is made near the batcher charging gate of the fine aggregate bin or in the fine aggregate batcher.

e. Scales

Adequate facilities shall be provided for the accurate measurement and control of each of the materials entering each batch of concrete. The weighing equipment and controls shall have accuracy within 0.2 percent of the scale capacity. The Contractor shall provide standard test weights and any other auxiliary equipment required for checking the operating performance of each scale or other measuring device. Tests shall be made at the frequency set by the Engineer in charge and in the presence of a representative of the Engineer in charge or a quality assurance representative. Each weighing unit shall include a visible indicator that shall indicate the scale load at all stages of the weighing operation and shall show the scale in balance at zero load. The weighing equipment shall be arranged so that the concrete plant operator can conveniently observe the indicators.

f. Operation and Accuracy

The weighing operation of each material shall start automatically when actuated by a single starter switch and shall end automatically when the designated amount of each material has been reached. These requirements can be met by providing an automatic batching system. There shall be equipment to permit the selection of four preset mixes each by the movement of not more than two switches or other control devices. Cumulative weighing will not be permitted. The weigh batchers shall be so constructed and arranged that the sequence and timing of batcher discharge gates can be controlled to produce a ribboning and mixing of the aggregates, water, admixtures, and cementitious materials as the materials pass through the charging hopper into the mixer. The plant shall include provisions to facilitate the inspection of all operations at all times. Delivery of materials from the batching equipment shall be within the following limits of accuracy:

ALLOWABLE MATERIAL VARIATION PERCENT

Cementitious materials	± 1
Water	± 1
Aggregate smaller than 37.5 mm	± 2
Aggregate larger than 37.5 mm	± 3
Chemical admixtures	± 3

g. Interlocks

Batchers and mixers shall be interlocked so that:

The charging device of each batcher cannot be actuated until all scales have returned to zero balance within ± 0.2 percent of the scale capacity and each volumetric device has reset to start or has signaled empty.

The charging device of each batcher cannot be actuated if the discharge device is open.

The discharge device of each batcher cannot be actuated if the charging device is open.

The discharge device of each batcher cannot be actuated until the indicated material is within the allowable tolerances.

One admixture is batched automatically with the water.

Each additional admixture is batched automatically with a separate portion of the water or with the fine aggregate.

The mixers cannot be discharged until the required mixing time has elapsed.

h. Recorder

An accurate recorder or recorders shall be provided and shall conform to the following detailed requirements:

(1) The recorder shall produce a graphical or digital record on a single visible chart or tape of the weight or volume of each material in the batchers at the conclusion of the batching cycle. The record shall be produced prior to delivery of the materials to the mixer. After the batchers have been discharged, the recorder shall show the return to empty condition.

(2) A graphical recording or digital printout unit shall be completely housed in a single cabinet that shall be capable of being locked.

(3) The chart or tape shall be so marked that each batch may be permanently identified and so that variations in batch weights of each type of batch can be readily observed. The chart or tape shall be easily interpreted in increments not exceeding 0.5 percent of each batch weight.

(4) The chart or tape shall show time of day at intervals of not more than 15 minutes.

(5) The recorder chart or tape shall become the property of the Owner.

(6) The recorder shall be placed in a position convenient for observation by the concrete plant operator and the Owner's inspector or Engineer in charge.

The recorded weights or volumes when compared to the weights or volumes actually batched shall be accurate within ± 2 percent.

i. Batch Counters

The plant shall include devices for automatically counting the total number of batches of all concrete batched and the number of batches of each preset mixture.

j. Rescreening Plant

A rescreening plant shall be located, arranged, and operated in a manner that all coarse aggregate will be routed through the plant and that its operation will ensure delivery to the mixers of graded coarse aggregate free from excessive variation and conforming to the size groups and grading of aggregates and with moisture content of the aggregates. Coarse aggregate may be rescreened and delivered to the batch plant bins one size group at a time or two or more adjacent size groups at a time. Simultaneous rescreening of nonadjacent size groups is not permitted. All material passing the bottom screens of the smallest size of coarse aggregate being screened shall be wasted.

k. Washing Plant

All coarse aggregates shall be washed immediately prior to entering the rescreening plant. The rewashing plant shall contain adequate water nozzles and vibrating screens to remove foreign materials and coatings from aggregate particles.

l. Trial Operation

Not less than 7 days prior to commencement of concrete placing, a test of the batching and mixing plant shall be made in the presence of the Engineer in charge to check operational adequacy. The number of full-scale concrete batches required to be produced in trial runs shall be as directed, will not exceed 20, and shall be proportioned as directed. All concrete produced in these tests shall be wasted or used for purposes other than inclusion in structures covered by this specification. All deficiencies found in plant operation shall be corrected prior to the start of concrete placing operations. No separate payment will be

made to the Contractor for labor or materials required by provisions of this paragraph. The Contractor shall notify the Engineer in charge of the trial operation not less than 7 days prior to the start of the trial operation.

m. Protection

The weighing, indicating, recording, and control equipment shall be protected against exposure to dust, moisture, and vibration so that there is no interference with proper operation of the equipment.

If the temperature of the concrete is required to be lowered at the time of manufacture, chilled water plant or ice storage facilities may have to be provided.

6.3 Water and Super Plasticizers:

Water and super plasticizers shall be batched by weight or by volume measures as approved by the Engineer. The method of batching shall be such as will ensure accuracy to 0.2 liters or better for water and 20 ml ore better for plasticizers.

The contractor shall provide the mixer operator with standard measures for dispensing water and plasticizers in accurate quantities as per design. Concrete mix containing water in excess of that specified in the mix design summary shall be rejected and shall not be allowed for use in works.

6.4 General Approval to the batching plant layout

Drawings, in triplicate, showing the layout of the plant the Contractor proposes to use on the work shall be submitted by the Contractor for review. The drawings shall show the locations of the principal components of the construction plant; offices; shop and storage building; housing facilities, if any; and storage areas and yards which the Contractor proposes to construct at the site of the work and elsewhere. The Contractor shall also furnish for review drawings, in triplicate, showing the general features of his aggregate processing plant; aggregate transporting; storage and reclaiming facilities; aggregate rinsing and dewatering plant, if required; coarse aggregate rescreening plant, if required; concrete batching and mixing plant; concrete conveying and placing plant; and when pre-cooling of concrete is required, the cooling plant. The drawing shall appropriately show the capacity of each major feature of the plant including the rated capacity of the aggregate production plant in tons per hour of fine and coarse aggregates; rated capacity of the aggregate transporting, storage and reclaiming facilities; volume of aggregate storage; capacity of cement and pozzolan storage; rated capacity of the concrete batching and mixing plant in cubic meters per hour; rated capacity of the concrete transporting and placing plant in cubic meters per hour; and when used rated capacity of plant for pre-cooling of concrete. Drawings in triplicate showing any changes in plant made during design and erection or after the plant is in operation shall be submitted for review. Two sets of the drawings will be retained and one set will be returned to the Contractor with comments.

7.0 TRANSPORT, PLACING AND COMPACTION OF CONCRETE:

7.1 General:

The method of transporting and placing concrete shall be approved by the Engineer. Concrete shall be so transported and placed that no contamination, segregation or loss of its constituent materials takes place. Transporting, placing, compacting and curing shall be done as per IS:456. Use of truck mixers, concrete pumps, placer booms, trolleys, rails, hoists, cranes and buckets etc. shall be adopted wherever possible and as per the requirement. The method statement of the transportation and placing of the concrete shall be submitted to the Engineer in Charge. In case any of the concrete transporting equipment is likely to impose loads and forces of any magnitude, on the partly or wholly completed structure or a part thereof, the structural consultant should be informed well in advance about the same. The structural consultant may have to take into account the forces arising out of operations and self-weights of these equipment's in the structural design of the building elements including its foundations. Failure to do so may result in denial to adopt certain transporting; placing and compacting methods on account of progress of the work already carried out at the site with a structural design no accounting for the same.

7.1 Transporting Equipment

Transporting equipment shall be designed, operated, and maintained so that it does not cause or permit segregation or loss of material. The concrete shall not be dropped vertically more than 1.5 m except where suitable equipment is provided to prevent segregation and where specifically authorized.

7.1.1 Buckets

Bottom-dump buckets shall conform to the following requirements: the interior hopper slope shall be not less than 70 degrees from the horizontal; the minimum dimension of the clear gate opening shall be at least five times the nominal maximum size of the aggregate, and the area of the gate opening shall not be less than 0.2 square meters; the bucket gates shall be grout-tight when closed, shall be of the double clamshell type, and shall be manually, pneumatically, or hydraulically operated; and the gate-opening mechanism shall be designed to close the gates automatically when the control is released or when the air or hydraulic line is broken. If gate actuation is dependent on integral air or hydraulic reservoirs, the capacity of the reservoirs shall be sufficient to open and close the gates three times without recharging the reservoir.

7.1.2 Trucks

Truck mixers shall not be used to transport concrete with larger than 37.5 mm nominal maximum-size aggregate or 50 mm or lower slump. Non-agitating trucks may be used for transporting central-mixed concrete over a smooth road when the hauling time is less than 15 minutes and the slump is less than 75 mm. Bodies of non-agitating trucks shall be smooth, watertight, metal containers specifically designed to transport concrete, shaped with rounded corners to minimize segregation, and equipped with gates that will permit positive control of the discharge of the concrete.

7.1.3 Chutes

When concrete can be placed directly from a truck mixer, agitator, or Non-agitating truck, the chutes supplied by the truck manufacturer as standard equipment may be used. A discharge deflector shall be used when required by the Engineer in charge. Separate chutes and other similar equipment shall not be permitted for conveying concrete except when specifically approved and in no case shall slump be increased to accommodate their use.

7.1.4 Belt Conveyors

Belt conveyors shall be designed and operated to assure a uniform flow of concrete from mixer or delivery truck to final place of deposit without segregation of ingredients or loss of mortar and shall be provided with positive means for preventing segregation of the concrete or loss of mortar at the transfer point(s) and the point of placing. The idler spacing shall not exceed 900 mm. Belt speed shall be a minimum of 90 m per minute and a maximum of 230 m per minute. Belt width shall be a minimum of 600 mm.

7.1.5 Pump Placement

Concrete may be conveyed by positive-displacement pump when approved. The pumping equipment shall be piston or squeeze-pressure type. The pipeline shall be rigid-steel pipe or heavy-duty flexible hose. Aluminum pipe shall not be used. The inside diameter of the pipe shall be at least 3 times the nominal maximum size of the coarse aggregate in the concrete to be pumped but not less than 100 mm.

7.2 Formwork and embedments:

All formwork and reinforcement contained in it shall be cleaned and made free from standing water, or dust, immediately before placing of concrete. Formwork, reinforcement, all embedment’s shown on all drawings, i.e. architectural, plumbing, electrical, air-conditioning, structural reinforcement, structural steel inserts, etc. shall be properly placed and secured tightly to the formwork or reinforcement as the case may be and Engineer's approval shall be taken in writing as regards their accuracy in terms of dimensions, locations, numbers, spacing, quality, adherence to specifications etc. before placing concrete in any part of the structure.

7.3 Approval from Engineer:

No concrete shall be placed in any part of the structure until the approval of the Engineer has been obtained in writing.

If concreting is not started within 24 hours of the approval being given, it shall have to be obtained again from the Engineer. Concreting then shall proceed continuously over the area between pre-determined construction joints. Fresh concrete shall not be placed against concrete that has been in position for more than 30 minutes unless a proper construction joint is formed.

7.4 Temperature during concreting:

Fine and coarse aggregates for concreting shall be kept shaded and the concrete aggregates sprinkled with water for a sufficient time before concreting in order to ensure that the temperature of these ingredients is as low as possible prior to batching. The mixer and the batching equipment shall be also shaded and if necessary painted white in order to keep their temperatures as low as possible.

Concrete when deposited shall have a temperature of not less than 4.5 degree centigrade and not more than 30 (plus or minus 2 degrees variation is allowed at the time of placement for the upper limit only) degrees centigrade unless otherwise specified.

Care shall be taken to protect freshly placed concrete from overheating by sunlight in the first few hours of laying. The time of day selected for concreting shall also be chosen so as to minimize placing temperatures. In case of concreting in exceptionally hot weather the Engineer may in his discretion specify the use of ice either flaked and used directly in the mix or blocks used for chilling the mixing water. In either case, the Contractor shall be paid only the cost of such ice delivered on site and nothing extra for additional labor involved in weighing and mixing.

7.5 Time lag between mixing and placing:

It shall be compacted in its final position within 30 minutes of its discharge from the mixer unless carried in properly designed agitators, operating continuously, when this time shall be within 2 hours of the addition of cement to the mix and within 30 minutes of its discharge from the agitator.

7.6 Placing:

Except where otherwise agreed to by the Engineer concrete shall be deposited in horizontal layers to a compacted depth of not more than 0.45 meter when internal vibrators are used and not exceeding 0.30 meter in all other cases.

Unless otherwise agreed to by the Engineer, concrete shall not be dropped into place from a height exceeding 2 meter. When trunks or chutes are used they shall be kept clean and used in such a way as to avoid segregation. When concrete is conveyed by chute, the plant shall be of such size and design as to ensure practically continuous flow. Slope of the chute shall be so adjusted that the concrete flows without the use of an excessive quantity of water and without any segregation of its ingredients. The delivery end of the chute shall be as close as possible to the point of deposit. The chute shall be thoroughly flushed with water before and after each working period and the water used for this purpose shall be discharged outside the formwork.

7.7 Compaction:

Internal (needle) and surface (screed board) vibrators of approved make shall be used for compaction of concrete.

Internal vibrators shall be used for compaction of concrete in foundations, columns, buttresses, arch sections etc. For sections such as slabs, the concrete shall be compacted by surface type vibrators. Depending on the thickness of layer to be compacted, 25 mm, 40 mm and 60 mm dia internal vibrators will be used. The concrete shall be compacted by use of appropriate diameter vibrator by holding the vibrator in position until:

i. air bubbles cease to come to surface

ii. Resumption of steady frequency of vibrator after the initial short period of drop in the frequency when the vibrator is first inserted.

iii. the tone of vibrator becomes uniform

iv. Flattened, glistening surface with coarse aggregate particles blended into it appear on the surface.

After the compaction is completed, the vibrator should be withdrawn slowly from the concrete so that concrete can flow in to the space previously occupied by the vibrator. To avoid segregation during vibration the vibrator shall not be dragged through the concrete nor used to spread the concrete. The vibrator shall be made to penetrate into the layer of fresh concrete below if any for a depth of about 150 mm. The vibrator shall be made

to operate at a regular pattern of spacing. The effective radii of action will overlap approximately half a radius to ensure complete compaction.

To secure even and dense surfaces free from aggregate pockets, vibration shall be supplemented by tamping or rodding by hand in the corners of forms and along the form surfaces while the concrete is plastic.

A sufficient number of spare vibrators shall be kept readily accessible to the lace of deposition of concrete to assure adequate vibration in case of breakdown of those in use.

25 mm diameter immersion vibrators shall be used in thin sections. 40 mm diameter immersion vibrators in fairly wide sections and 60 mm diameter vibratos in foundations and arch abutments. Screed vibrators shall be used for precast deck elements and in the in-situ deck slab concreting where the thickness of the slab is 50 mm.

Plain concrete in foundations shall be placed in direct contact with the bottom of the excavation, the concrete being deposited in such a manner as not to be mixed with the earth. Plain concrete shall be vibrated to achieve full compaction, using needle or screed vibrators as necessary.

Direct contact between vibrator and reinforcement or inserts and embedment's should be avoided.

7.8 Protection of wet concrete:

Concrete placed below the ground shall be protected from falling earth during and after placing. Concrete placed in ground containing deleterious substances shall be kept free from contact with such ground and with water draining therefrom during placing and for a period of seven days or as instructed thereafter. Approved means shall be taken to protect immature concrete from damage by debris, excessive loading, abrasion, vibrations, and deleterious ground water, mixing with earth or other concrete.

8.0 CURING OF CONCRETE:

8.1 Protection and Water Curing:

Immediately after compaction, concrete shall be protected against harmful effects of weather, including rain, running water, shocks, vibration, traffic, rapid temperature changes, and drying out process. It shall be covered with wet sacking, Hessian or other similar absorbent material approved by the Engineer soon after the initial set, and shall be kept continuously wet for a period of not less than 21 days from the date of placement. Masonry work over the foundation concrete may be started after 48 hours of it's laying but the curing of concrete shall be continued for a minimum period of 21 days.

9.0 WORKING IN EXTREME WEATHER:

When depositing concrete in very hot weather, precautions shall be taken so that the temperature of wet concrete does not exceed 30 degrees centigrade while placing. This shall be achieved by stacking aggregate under the shade and keeping them moist, using cold water or crushed or flaked ice if specified and permitted by the Engineer, reducing the time between mixing and placing to the minimum, cooling formwork by sprinkling water, starting curing before concrete dries out and restricting concreting, as far as possible, to mornings and evenings. During hot weather and rains the concrete shall be covered with tarpaulins and transported in as short a time as possible and placed in the forms and consolidated to final state.

Commencement of concrete pours shall be avoided during heavy rains, storms and high winds.

10.0 CONSTRUCTION JOINTS:

Concreting shall be carried out continuously joints, the position and details of which shall be as shown on approved drawings or as directed by the Engineer. Such joints shall, however, be kept to the minimum.

For a vertical construction joint, a stopping board shall be fixed previously at the pre-determined position and shall be properly stayed for sufficient lateral rigidity to prevent its displacement or bulging when concrete is compacted against it. Concreting shall be continued right up to the board. The board shall not be removed before the expiry of the specified period for removal of vertical forms.

10.1 Joint Preparation

Concrete surfaces to which other concrete is to be bonded shall be prepared for receiving the next lift or pour or adjacent concrete by cleaning by sandblasting, high-pressure water jet, or air-water cutting. Surface cutting by air-water jets will not be permitted for concrete surfaces congested with reinforcing steel or if they are relatively inaccessible. If, for any other reason, it is considered undesirable to disturb the surface of a lift or pour before it has hardened, the use of sandblasting or high-pressure water jet after hardening will be required. Regardless of the method used, the resulting surface shall be free from all laitance and inferior concrete so that clean, well-bonded coarse aggregate particles are exposed uniformly over the lift or pour surface. Application of the joint treatment method shall be such that the edges of the larger particles or aggregate are not undercut. Where joint preparation occurs more than 2 days prior to placing the next lift or pour or where the work in the area subsequent to the joint preparation causes dirt or debris to be deposited on the surface, the surface shall be cleaned as the last operation prior to placing the next lift or pour. The surface of the construction joint shall be kept continuously wet for the first 12 hours of the 24 hours prior to placing concrete, except that the surface shall be damp with no free water at the time of placement.

10.1.2 Air-Water Cutting

Air-water cutting of a construction joint shall be performed at the proper time, generally between 4 and 12 hours after placement and only on horizontal construction joints. This period may be modified if a retarder is used to prolong the setting of the cement at surface of the concrete.

The air pressure used in the jet shall be 620 to 760 kPa, and the water pressure shall be just sufficient to bring the water into effective influence of the air pressure. When approved a surface retarder may be applied to the surface of the lift or pour to prolong the period of time during which air-water cutting is effective. Prior to receiving approval, the Contractor shall furnish samples of the material to be used and shall demonstrate the method to be used in its application. After cutting, the surface shall be washed and rinsed until the wash water is no longer cloudy. If air-water cutting does not produce acceptable results, the surface shall be prepared by high-pressure water jet or sandblasting.

10.1.3 High-Pressure Water Jet

A stream of water under a pressure of not less than 21 MPa may be used for cleaning. Its use shall be delayed until the concrete is sufficiently hard so that only the surface skin or mortar is removed and there is no undercutting of coarse-aggregate particles. If the high-pressure water jet is incapable of a satisfactory cleaning, the surface shall be cleaned by sandblasting.

10.1.4 Wet Sandblasting

This method of joint preparation may be used when the concrete has reached sufficient strength to prevent undercutting of coarse aggregate particles.

The operation shall be continued until all accumulated laitance, coatings, stains, debris, and foreign materials are removed. The surface of the concrete shall then be washed thoroughly to remove all loose material.

This method may be used on both horizontal and vertical surfaces.

When work has to be resumed on a surface, which has hardened, it shall be thoroughly hacked, swept clean, wetted and covered with a layer of neat cement grout. The neat cement grout shall be followed by a 15 mm thick layer of mortar mixed in the same proportion as in concrete and concreting resumed immediately thereafter. The first batch of concrete shall be rammed against the old work to avoid formation of any stone pockets, particular attention being paid to corners and close spots.

In all cases, the position and detailed arrangement of all construction joints shall be predetermined and got approved by the Engineer.

No separate payment shall be allowed to the contractor for forming joints or chipping and cleaning them. When a horizontal construction joint is formed, provision shall be made for interlocking with the succeeding layer by the embedment of saturated wooden blocks or strips beveled on four sides to facilitate their removal. Prior to the next pour, the wooden pieces shall be loosened and removed in such a manner as to avoid injury to the concrete.

11.0 TESTS AND STANDARD OF ACCEPTANCE:

11.1 Preliminary Tests for Controlled Concrete:

For controlled concrete preliminary tests referred to in paras 2.1 & 3 shall consist of three sets of separate tests, and in each set, tests shall be conducted on six specimens. Not more than one set of six specimens shall be made on any particular day. Of the six specimens in each set, three shall be tested at seven days and the remaining three at 28 days. The preliminary tests at 7 days are intended only to indicate the strength likely to be attained at 28 days.

The contractor is entirely responsible for the design of the concrete mixes. The design is however to be approved by the Engineer. At least 8 weeks before commencing any concreting in the works, the contractor shall make trial mixes using samples of coarse aggregates, sand, water, plasticizers and cement, typical of those to be used in the works and which have been tested in an approved laboratory. A clean dry mixer shall be used and the first batch discarded. The use of plasticizers cum retarders of approved quality at Contractor's own cost is mandatory.

For each grade, a total of 18 cubes shall be made. Of these 18 cubes, not more than 6 may be made on any day and further, of the 6 cubes made in one day not more than 2 cubes may be made from any single batch. 9 of these cubes, each representing a different batch of concrete shall be tested at the age of 7 days and the remaining 9 cubes shall be tested at the age of 28 days. The making of the cubes, their curing, storing, transporting and testing shall be in accordance with IS: 516.

If the average strength of the concrete cubes falls below the required target means strength, fresh preliminary mixes for that grade shall be made as before, until the trial mixes yield cubes of compressive strength at 28 days greater than the required average target mean strength at that age.

Whenever there is a significant change in the quality of any of the ingredients for concrete, the Engineer may at his discretion order the carrying out of fresh trial mixes. All costs for trial mixes and tests shall be to the Contractor's account and held to be included in the Contract Rates.

Before commencing the works, the Contractor shall submit to the Engineer, the full details of all preliminary trial mixes and tests for his approval.

The Contractor shall carry out trial casting of a mockup of at least one meter length of an RCC member to establish the correctness of grading aggregates, suitability of mould oil proposed to be used on formwork to prevent surface blemishes etc.. All costs of such trial casting shall be included in the Contract Rates.
Whenever the quality or brand or source of ingredients used in the approved trial mix changes on any account, fresh preliminary tests conforming to all the above requirements shall be carried out and the mix shall be approved by the Engineer before carrying out concreting with the new mix.

11.2 Works Strength Tests for Controlled and Ordinary Concrete:

Work strength tests shall be made in accordance with IS:516. Each test shall be conducted on six specimens, three of which shall be tested at 7 days and the remaining three at 28 days. The samples of concrete shall be taken on each day of concreting and cubes shall be made at the rate of one set for every 10 cubic meter of concrete or a part thereof for each grade.

Similar works test shall be carried out whenever the quality and grading of materials is changed irrespective of the quantity of concrete poured. The number of specimens may be suitably increased as deemed necessary by the Engineer, when procedure of tests given above reveals a poor quality of concrete and in other special cases.

All work shall be carried out under the supervision of qualified and competent Engineer appointed by and working on behalf of the Contractor (not the Project Manager) who will supervise proportioning, placing and compacting of concrete at all stages.

If concrete is batched at more than one point simultaneously, the above frequency of making cubes shall be followed at each point of batching.

All necessary labor, materials, equipment, etc. for sampling preparing test cubes, curing, etc. shall be provided by the Contractor. Testing of the materials and concrete may be arranged by the Engineer in an approved laboratory at the cost of the Contractor.

11.3 Standard of Acceptance:

11.3.1 The strength requirement of any particular grade of concrete will be considered satisfactory if the 28 days compressive strengths of individual sets (each set consists of 3 cubes) and of individual cubes satisfy the following requirements:

For the first five sets:

a. The average strength determined from any group of three consecutive test cubes exceeds the specified characteristic strength by not less than 0.8 times the current margin.

b. Only one individual cube test result in any set may fall below the specified characteristic strength provided that this value is not less than 95% of the specified characteristic strength.

After the first five sets:
Provided that the average strength of any fifteen consecutive cubes exceeds the specified current margin all the subsequent test results may be considered acceptable if :

a. the average strength as determined from any group of three consecutive test cubes exceeds the specified characteristic strengths by not less than 0.6 times the current margin.

b. Only one individual cube test result in any set may fall below the specified characteristic strength provided that this value is not less than 90% of the specified characteristic strength.

11.3.2 If the concrete produced at site does not satisfy the above strength requirements, the Engineer will reserve the right to require the Contractor to improve the methods of batching, the quality of the ingredients and redesign the mix with increased cement content if necessary. The Contractor shall not be entitled to claim any extra cost for the extra cement used for the modifications stipulated by the Engineer for fulfilling the strength requirement specified.

11.3.3 The above specification is based on an assumed standard deviation of 5.5 MPa and probability of concrete strength falling below the desired min9mum strength of 1 in 20. In case quality control is very good at site and the cube test results consistently show a standard deviation better than the standard deviation assumed herein, the Engineer may at his discretion reduce the required target strength for any particular grade of concrete and in consequence the current margin.

11.4 Failure to meet specified Requirements:

11.4.1 If from the cube test results it appears that some portion of the works has not attained the required strength, the Engineer may order that that portion of the structure be subjected to further testing of any kind whatsoever as desired by the Engineer, including if so desired by him, full load testing of the suspected as well as adjacent portions of the structure as specified in the conditions of contract. Such testing shall be at the contractor's cost. The Engineer may also reject the work and order its demolition and reconstruction at the Contractor's cost.

11.4.2 If the strength of concrete in any portion of the structure is lower than the required strength, but is considered nevertheless adequate by the Engineer so that demolition is not necessary, the Contractor shall be paid lower rate for such lower strength concrete as determined by the Engineer.

11.5 Field Tests:

As frequently as the Engineer may require, testing shall be carried out in the field for:

a. Moisture content and absorption and density of sand and aggregates.
b. Silt content in sand
c. Grading of sand and aggregates
d. Slump test of concrete
e. Concrete cube test
f. Permeability test for concrete as per DIN 1048 (Part-I). Mass available permeability on untreated concrete surface 25 mm.
g. Density and pH value of Plasticizer.

The Contractor shall provide and maintain on site at all times, until the works are completed, equipment and staff required for carrying out these tests. The contractor shall grant the Engineer or his representative full access to his laboratory at all times and shall produce on demand complete records of all tests carried out on site.

11.6 Manufacturer's Certification; Testing Results etc.:

For all materials required for concrete construction including cement, aggregate, water, reinforcing and prestressing steel the original copies of test certificates, test results etc. either carried out by the manufacturer or any other agency, the mix design recommendations etc. Shall be submitted to the Engineer for his approval and record. It shall remain the property of the Engineer.

11.7 Chloride Contents:

Since the chloride contents of the constituent materials of the concrete would be additive, it is desirable to keep a check on the overall chloride content of the concrete to keep it minimal. The total chloride content of the concrete when manufactured according to the requirements of workability and strength shall not exceed 500 PPM., by weight of cement. The costs of testing for the chloride content of the ingredients of concrete and of undertaking remedial measures if the chloride content is more than the permissible limit shall be borne by the contractor.

12.0 REPAIR WORK:

Concrete, which is unsatisfactory, shall be repaired by cutting out the unsatisfactory material and by replacing it with new concrete. Voids to be so filled shall be provided with anchors, keys or dovetail slots whenever necessary to attach the new material securely in place. Surface of prepared voids shall be wetted for 24 hours immediately before the patching material is placed. Repair of concrete shall be made by skilled workmen. Repairs shall be made as soon as practicable after removal of forms and in a manner to meet the requirements for the finish specified for the particular location.

Repairing leakages in liquid retaining structures which become apparent during leak-testing will also have to be repaired by the Contractor at his own cost following methods and specifications as directed by the Engineer.

For repair of the concrete works, the contractor may use epoxy as a bonding agent prior to placing fresh concrete. The use or otherwise of epoxy for the repair work will be at the discretion of the Engineer. Epoxies shall be applied in strict accordance with the instructions of the manufacturer.

Approved brands of repair material and chemicals shall be used to repair surfaces of damaged concrete at the discretion of the Engineer. The repair work shall be carried out strictly in accordance with the manufacturer's recommendations as regards the preparation of surface, cleaning, hacking, applying bonding agents, admixtures, polymer mortars etc. Any deviation shall be certified by the Engineer before being brought into execution.

Filling material or grout used in repair of surfaces which will be exposed after completion of the project shall be made with cement from the same sources as that used in concrete and blended with a sufficient amount of white Portland cement to produce the same color as in the adjoining concrete. Patched surfaces shall be given a final treatment as required to make the texture of the patch match that of the surrounding material.

Immediately after patching is completed, the patched area shall be covered with an approved nonstaining, water-saturated material, which shall be kept wet and protected against sun and wind for a period of 12 hours. Thereafter, the patched area shall be kept continuously wet by a fine spray or sprinkling for not less than 10 days. The layers of gunite may be reinforced with steel mesh if directed by the Engineer.

All materials, procedures and operations used in the repair of concrete and also the finished work shall be subject to the approval of Engineer. All fillings shall be tightly bonded to the concrete and shall be sound, free from shrinkage cracks or dummy areas after the fillings have been cured and dried.

The extent of repair shall be decided upon by the Engineer. The cost of repairs of defective areas shall be borne by the contractor. The engineer may adopt at his discretion any other method of repairing like grouting with cement grout, epoxy grouts or guniting etc. Which will be carried out by the contractor at his cost as per the specifications supplied by the Engineer.

Repairing shall be carried out only if the Engineer feels that it is sufficient only to repair the concrete and demolition and reconstruction is not necessary.

13.0 USE OF PLUMS IN ORDINARY CONCRETE:

Stone plums shall not be used unless specified on the drawings, when used the size of stone plums may be from 150 to 300 mm. The maximum dimension of these stones or plums shall not exceed 1/3rd the least dimension of the members.

All plums shall be hard, durable, clean and free from soft materials or loose pieces or deleterious substance in them and shall not have sharp corners.

During concreting the first layer of concrete of the specified mix shall be laid to a thickness of at least two and a half times the thickness of the maximum size of plums to be used. The plums shall then be laid while the top portion of this concrete is still green but sufficiently stiff to prevent complete submergence of the plums under their own weight. These plums shall be about half embedded in the concrete and the remaining part exposed so as to form a key with the next layer of concrete. No plums shall be used for concrete laid under water.

While placing the plums, care shall be taken to see that the clear distance between any two plums is not less than either the width of thickness of either of the plums. The distance from plums to the outer surface or from any steel reinforcement shall be equal to greatest width of the plum.

If plums of stratified stones are used, they shall be laid on their natural bed. Stones with concave faces shall be laid with the concave upwards.

The thickness of the next and successive layers of concrete shall be at least twice that of the largest plums.

The total volume of plums shall not exceed 20 percent of the volume of the finished concrete.

14.0 MEASUREMENT FOR PAYMENT:

i) The cement concrete shall be measured in cubic meters. In reinforced concrete the volume occupied by reinforcement shall not be deducted.

ii) Any concrete used in excess of the theoretical dimensions as shown on the drawings will not be paid.

iii) Unacceptable Work:

All defective concreting work, including but not limited to defects arising out of honeycombing, under sizing, etc. Are liable to be demolished and rebuilt by the Contractor at his own cost. In the event of such works being accepted by carrying out repairs etc. as specified by the Engineer, the cost of repair will be borne by the contractor. In the event of the works being accepted by giving a design concession' arising out of but not limited to under sizing, understrength, by accepting high design stresses in members, or accepting materials

not fully meeting the specifications etc. The Contractor will be paid for the work actually carried out by him at the reduced rate of 75% of the tendered rate for portion of the work thus accepted.

15.0 RATE:

The unit rate for concrete shall include the cost of all materials, labor, tools and plant required for mixing, placing in position, vibrating and compacting, finishing as per directions of the Engineer, curing and all other incidental expenses for producing concrete of specified strength to complete the structure or its components as shown on the drawings and according to these specifications. The rate shall also include the cost of making, fixing and removing off all centers and forms required for the work unless otherwise specified in the contract.

All expenses likely to be incurred by the contractor in transporting materials supplied to him to the site of works, the expenses incurred in improving the quality of materials to acceptable levels (such as screening, washing etc.) And the expenses incurred in proper storage of materials as directed by the Engineer etc., are to be included in the unit rate.

16. TOLERANCES:

16.1 Tolerances in Reinforced Concrete Work:

Description	**Permissible Departure**
Departure from established Alignment of all elements	30 mm.
Departure from established grades	10 mm.
Variation from plumb or specified) Batter in lines and surface) Columns, piers, walls and in rises)	12 mm in 3 m. if exposed 25mm in 3 m. if backfilled
Variation from level or indicated) Grade in slabs, beams, horizontal) And railing offsets.	12 mm in 3 m. if exposed 25 mm in 3 m. if backfilled
Variation in cross sectional Dimensions of columns, piers, Slabs, walls and beams. :	-6 mm to +12 mm
Variation in slab thickness :	-3 mm to + 6 mm
Footings: plan dimensions :	-15 mm to + 30 mm
Misplacement or eccentricity:	2% of footing width in The direction of misplacement and not Exceeding 30 mm.
Reduction in thickness :	5% of specified thickness
Variations in size and location: of slabs, wall openings.	12 mm

Notwithstanding the above allowances, it is presumed that all works will be carried out true to the lines, levels and grades shown on the drawings and within the tolerances specified below. The contractor shall establish, erect and maintain in an undisturbed condition, until final completion and acceptance of the project, control points and bench marks necessary and adequate to establish these tolerances

iii)**: STRUCTURAL STEEL WORK**

A. Applicable for all Items of work as per BOQ Ref Item No.II(12),VII(14)

B. GENERAL RECOMMENDATIONS FOR STEELWORK

Preparing shop drawings, obtaining Structural consultants approval, supplying, fabricating in accordance with IS:800, delivering at site, hoisting and fixing in position, including all temporary staging and supporting work and making all structural steel work in accordance with the design, drawings prepared by the consultants. The rate of steel work shall include cutting, grinding, machining, assembly, welding, jointing, building up new sections, cost of fasteners (nuts, bolts and washers), pre-heating the sections to temperatures up to 250 degree C if thickness of the section is equal to or more than 25 mm.Fabrication will involve connections using plates, channels and angles, gusset plate, foundation bolts, cleats, fasteners etc. as per drawing, steel conforming to IS : 226 and IS : 2062 with minimum yield strength of 350 Mpa and upto 355 Mpa. The rate shall also include 2 coats of Synthetic Enamel Paint of Approved Make & Colour over a coat of zinc rich primer after properly cleaning the steel surface with wire brush and mild acid solution followed by washing with water and drying the surface completely.

For Supplying, fabricating, conveying, hoisting, erecting in position structural steel works comprising of trusses, purlins, lattice girders, portal frames, brackets, columns, bracings, base plates, gussets & other connected steel work with MS rolled steel sections/built up sections, welded, bolted and/or riveted, anchors, bolts, inserts in RCC / Masonary and other works etc, complete, as shown in detailed approved shop drawings including straightening, cutting, welding, hoisting with sand blasting, spray galvanising & painting zinc rich primer one before & one after erection with 2 coats of synthetic enamel paint of appvd brand & color after erection. Only standard weights as per IS code shall be considered for measurement and payment. For Pergollas,RCC Jalli works, Edge angles, MS Ladders, Grattings for UG Sump & STP and other areas as specified in the Detailed drgs.

1. Exchange of Information

Before the beginning of the execution of the contract, the Steel Fabrication and / or Erection contractor shall ensure that he is in the knowledge of the following information from the team of architect, structural consultant, services consultant, Project Managers, Supervisors, Clerk of Works and the Owner.

a. Site plans showing in plan and elevation of the proposed location and main dimensions of the building or structure;

b. Ground levels, existing and proposed;

c. Site plans showing in plan and elevation of the proposed location and main dimensions of the building or structure;

d. Particulars of buildings or other constructions which may have to remain on the actual site of the new building or structure during the erection of the steelwork;

e. Particulars of adjacent buildings affecting, or affected by, the new work;

f. Stipulation regarding the erection sequence or time schedule;

g. Conditions affecting the position or continuity of members;

h. Limits of length and weight of steel members in transit and erection;

i. Drawings of the substructure, proposed or existing, showing:

j. levels of stanchion foundations, if already determined

k. any details affecting the stanchion bases or anchor bolts

l. permissible bearing pressure on the foundation and

m. provisions for grouting

n. The grade of fire resistance appropriate to the occupancy as may be required.

o. Climatic conditions at site-seasonal variations of temperature, humidity, wind velocity and direction;

p. Nature of soil. Results of the investigation of sub-soil at site of building or structure;

q. Accessibility of site and details of power supply;

r. Whether the steelwork contractor will be required to survey the site and set out or check the building or structure lines, foundations and levels;

s. Setting-out plan of foundations, stanchions and levels of bases;

t. Cross sections and elevations of the steel structure, as necessary, with large-scale details of special features;

u. Whether the connections are to be bolted, riveted or welded. Particular attention should be drawn to

connections of a special nature, such as turned bolts, high strength friction grip bolts, long rivets and overhead welds;

v. Quality of steel, and provisions for identification;
w. Requirements in respect of protective paintings at works and on site, galvanizing or cement wash;
x. Approximate dates for commencement and completion of erection;
y. Details of any tests which have to be made during the course of erection or upon completion; and
z. Schedule of quantities. Where the tenderer is required to take off quantities, a list should be given of the principal items to be included in the schedule.

2. Drawings

2.1. Before the commencement of fabrication or erection of any steelwork, the relevant drawings showing the details of fabrication, dimensions and geometrical specifications and nomenclature of members, layout and diameter of holes, chamfers, curves, radii, provisions for assembly of steelwork and methods of erection shall be furnished by the Contractor for obtaining the approval of the Engineer.

2.2. Where welding is to be used, the shop drawings shall give full particulars of "weld preparation" and procedure of carrying out the work. Four copies of each drawing shall be submitted before commencement of fabrication to enable the Engineer to check the drawings and no work shall be carried out before obtaining his final approval after incorporating any comments and suggestions that he might have offered during the course of verifying the shop drawings with respect to the design drawings. All work shall be fabricated in accordance with the approved drawings.

3. Materials

3.1. The Contractor shall, if requested, furnish the Engineer with copies of test certificates showing that all the principal materials comply with the requirements of IS 226 or other applicable standards. If the Engineer requires further tests to be carried out, the Contractor shall provide the necessary test- pieces or samples at his cost, and shall transport them to an approved testing laboratory.

3.2. All steel shall be straight, sound, free from defects such as twists, segregation, cracks, surface flaws, laminations, imperfect edges, and other defects.

4. Storage of materials

4.1. All material shall be stored properly on a raised platform. It shall be kept clean and properly drained. Structural steel shall be so stored and handled that members are not subjected to excessive stresses and damage. Long members, such as columns shall be supported so as to prevent excessive deflection.

5. Design Drawings and Bill of Quantities

Description of structural steel members, notes, dimensions, instructions, sequence of construction, loading standards, connection details, specific tolerances, material specifications etc. shown on drawings shall be overriding those mentioned in the Bill of Quantities and these Specifications.

Description of structural steel members, notes, dimensions, instructions, sequence of construction, loading standards, connection details, specific tolerances, material specifications etc. mentioned in the Bill of Quantities shall be overriding those mentioned in these Specifications.

In absence of any mention of specifications of material, workmanship, sequence of work, tolerances, connection details, etc., these specifications shall be used. However, in case of discrepancy observed among any parts of information in any two or more construction documents related to a specific instance, the structural consultants must be approached immediately and clarification sought in writing before proceeding to execute further work.

B. FABRICATION

1. Fabrication

1.1. All the steelwork shall be fabricated in shops, duly approved by the Engineer, and assembled/bolted at site. Before commencement of fabrication of any steelwork, all plates and sections shall be carefully examined for laminations and other defects likely to affect the finished structure. Sections and plates shall be straightened and made true by approved methods so that when assembled the adjacent surfaces at connections will be in close contact throughout.

1.2. Accuracy shall be maintained during fabrication to ensure that all parts fit together properly during erection. All corresponding parts shall be similar and interchangeable.

2. Workmanship

2.1. General

The workmanship shall be equal to the standard practice followed in modern structural shops. All similar parts shall be manufactured accurately so that the same could be interchanged with other parts having the same identification marks.

2.2. Templates

Templates used shall be of steel In case where actual parts have been used as templates for drilling similar pieces, the Engineer shall decide whether they are fit to be used.

2.3. Straightening

All members shall be reasonably straight and free from twists. If considered necessary, the same shall be straightened and/or attended to, in order to bring it to the specified configuration by pressure or by methods that will not reduce the properties of the material below the values used in design. Local application of pressure at room or elevated temperature or other thermal means may be used for straightening, provided the above is satisfied.

2.4. Clearance

Individual members shall be cut to such lengths that the erection clearance for cleated ends of members connecting steel to steel should not be greater than 2 mm at each end. The erection clearance at ends of beams without cleats should not be more than 3 mm at each end; but for practical reasons, if greater clearance is considered necessary, suitably designed seatings or connections shall be provided.

3. Shearing, flame cutting and planing

3.1. Cutting

a. Cutting shall be effected by sawing, shearing, cropping, machining or thermal cutting process. Shearing, cropping and gas cutting shall be clean, reasonably square, and free from any distortion. Should the inspector find it necessary, the edges shall be ground after cutting. Planing or finishing of sheared or gas-cut edge of plates or shapes shall not be required, unless specially noted on drawing or included in stipulated edge preparation for welding or when specifically required in the following section.

b. Re-entrant corners shall be free from notches and shall have largest practical radii with a minimum radius of 15 mm.

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

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

3.2. Shearing

a. Shearing of items over 16 mm thick to be galvanized and subject to tensile force or bending moment shall not be carried out, unless the item is stress relieved subsequently.

b. The use of sheared edges in the tension area shall be avoided in location subject to plastic hinge rotation at factored loading.

c. Shearing or Sheared members shall be free from distortion at sheared edges.

3.3. Thermal Cutting

a. Gas cutting of high tensile steel by mechanically controlled torch may be permitted, provided special care is taken to leave sufficient metal to be removed by machining, so that all metal that has been hardened by flame is removed. Hand flame cutting may be permitted only subject to the approval of the inspector. Flame cutting may be used at the Contractor's option provided, a mechanically controlled cutting torch is used for the flame-cutting and the resulting edge is reasonably clean and straight. Edge preparation for welding may be done by machine controlled flame cutting with edges free of burns, clean and straight.

b. When gas cutting is adopted, the flame cut edges shall be machined to a depth of 3 to 5 mm depending on the thickness of the member. Thermally cut free edges, which shall be subject to calculated static tensile stress shall be free from round bottom gouges greater than 5 mm deep. Gouges greater than 5mm deep and notches shall be removed by grinding. All flame-cut edges shall be planed, unless they are clean, square and true to shape.

c. Except where the material is subsequently joined by welding, no load shall be transmitted through a gas cut surface.

4. Machining of Butts, Caps and Bases

4.1. Column splices and butt joints of struts and compression members, depending on contact for stress transmission, shall be accurately machined and close-butted over the whole section with a clearance not exceeding 0.2 mm locally at any place. Sum of all such clearance shall not be more than 30% of the contact area for stress transmission. In column caps and bases, the ends of shafts together with the attached gussets, angles, channels, etc. after connecting together should be accurately machined so that clearance between the contact surfaces does not exceed 2 mm locally, subject further to the condition that sum total of all such clearance does not exceed 30% of the total contact area for stress transmission. Care should be taken that these gussets, connecting angles or channels are fixed with such accuracy that they are not reduced in thickness by machining by more than 2.0 mm.

4.2. Where sufficient gussets and rivets or welds are provided to transmit the entire loading (Section **4**), the column ends need not be machined.

4.3. *Slab Bases and Caps* – Slab bases and slab caps, except when cut from material with true surfaces, shall be accurately machined over the bearing surfaces and shall be in effective contact with the end of the stanchion, bearing face which is to be grouted to fit tightly at both top and bottom, unless welds are provided to transmit the entire column face.

4.4. To facilitate grouting, sufficient gap shall be left between the base plates and top of pedestal and holes shall be provided where necessary in stanchion bases for the escape of air.

5. Holing

5.1. Drilling - Holes through more than one thickness of material for members, such as compound stanchion and girder flanges shall be, where possible, drilled after the members are assembled and tightly clamped or bolted together. A round hole for a bolt shall either be machine flame cut, or drilled full size, or sub-punched 3 mm undersize and reamed to size, punched full size.

5.2. Hand flame cutting of a bolt hole shall not be permitted except as a site rectification measure for holes in column base plates.

5.3. Punching – A punched hole shall be permitted only in material whose yield stress (fy) does not exceed 360 MPa and where thickness does not exceed (5600/fy) mm. In cyclically loaded details, punching shall be avoided.

5.4. For greater thickness and cyclically loaded details, holes shall be either drilled from the solid or sub-punched or sub drilled and reamed.

5.5. The die for all sub-punched holes or the drill for all sub-drilled holes shall be at least 3mm smaller than the required diameter of finished hole.

5.6. Oversize holes – A special plate washer of minimum thickness 4 mm shall be used under the nut, if the hole diameter is larger than the bolt diameter by 3 mm or more.

5.7. Oversize hole shall not exceed 1.25d or (d+8) mm in diameter, where d = nominal bolt diameter in mm

5.8. A short slotted hole shall not exceed the appropriate hole size in width and 1.33d in length, A long slotted hole shall not exceed the appropriate hole size in width and 2.5d in length. If the slot length is larger than those specified, shear transfer in the direction of slot is not admissible even in friction type of connection

5.9. Slotted holes shall be punched either in one operation or else formed by punching or drilling two round holes apart and completed by high quality mechanically controlled flame cutting and dressing to ensure that bolt can freely travel the full length of the slot.

5.10. Fitted Bolt Holes – Holes for turned and fitted bolts shall be drilled to a diameter equal to the nominal diameter of the shank or barrel subject to tolerance specified in IS: 919. Preferably, parts to be connected with close tolerance or barrel bolts shall be firmly held together by tacking bolts or clamps and the holes drilled through all the thicknesses at one operation and subsequently reamed to size. All holes not drilled through all thicknesses at one operation shall be drilled to a smaller size and reamed out after assembly. Where this is not practicable, the parts shall be drilled and reamed separately through hard bushed steel jigs.

5.11. Holes for rivets or bolts shall not be formed by gas cutting process.

6. Assembly

6.1. All parts of bolted and welded members shall be held firmly in position by means of jigs or clamps while bolting or welding. No drifting of holes shall be permitted except to draw the parts together and no drift shall be larger than the nominal diameter of bolt. Drifting carried out during assembly shall not distort the metal or enlarge the holes.

6.2. Trial assemblies shall be carried out at the fabrication stage to ensure accuracy of workmanship. These checks shall be witnessed by the Engineer.

6.3. The component parts shall be assembled and aligned in such a manner that they are neither twisted nor otherwise damaged, and shall be so prepared that the specified cambers, if any, is provided.

6.4. Holes in Assembly – When holes are drilled in one operation through two or more separable parts, these parts, when so specified by the engineer, shall be separated after drilling and the burrs removed.

6.5. Matching holes for rivets and black bolts shall register with each other so that a gauge of 1.5 mm or 2.0 mm (as the case may be depending on whether the diameter of the rivet or bolt is less than or more than 25 mm) less in diameter than the diameter of the hole will pass freely through the assembled members in the direction at right angle to such members.

6.6. Drilling done during assembly to align holes shall not distort the metal or enlarge the holes

6.7. Holes in adjacent part shall match sufficiently well to permit easy entry of bolts. If necessary, holes except oversize or slotted holes may be enlarged to admit bolts by moderate amount of reaming.

6.8. Thread length – When design is based on bolts with unthreaded shanks in the shear plane, appropriate measures shall be specified to ensure that, after allowing for tolerance, neither the threads nor the thread run-out will be in the shear plane.

6.9. The length of bolt shall be such that at least one clear thread shows above the nut and at least one thread plus the thread run out is clear beneath the nut after tightening. One washer shall be provided under the rotated part.

6.10. Assembly subjected to vibration – If non-preloaded bolts are used in structure subject to vibration, the nuts should be secured by locking devices or other mechanical means. The nuts of preloaded bolts may be assumed to be sufficiently secured by the normal tightening procedure.

6.11. Washers – Washers are not normally required or non-preloaded bolts, unless specified otherwise. Tapered washers shall be used where the surface is inclined at more than 3o to a plane perpendicular to the bolt axis.

6.12. Hardened washer shall be used for preloaded bolts or the nut whichever is to be rotated.

6.13. All material within the grip of the bolt shall be steel and no compressible material shall be permitted in the grip.

7. Riveting

7.1. Rivets shall be heated uniformly throughout their length, without burning or excessive scaling, and shall be of sufficient length to provide a head of standard dimensions. They shall, when driven, completely fill the holes and, if countersunk, the countersinking shall be fully filled by the rivet, any protrusion of the countersunk head being dressed off flush, if required.

7.2. Riveted member shall have all parts firmly drawn and held together before and during riveting, and special care shall be taken in this respect for all single-riveted connections. For multiple riveted connections, a service bolt shall be provided in every third or fourth hole.

7.3. Wherever practicable, machine riveting shall be carried out by using machines of the steady pressure type.

7.4. All loose, burned or otherwise defective rivets shall be cut out and replaced before the structure is loaded, and special care shall be taken to inspect all single riveted connections.

7.5. Special care shall be taken in heating and driving long rivets.

8. Bolting

8.1. In all cases where the full bearing area of the bolt is to be developed, the bolt shall be provided with a washer of sufficient thickness under the nut to avoid any threaded portion of the bolt being within the thickness or the parts bolted together, unless accounted for in design.

8.2. Pretensioned bolts shall be subjected initial tension to the proof stress by an appropriate precalibrated method.

9. Welding

Welding of structural steelwork shall be carried out by the metal arc process and shall be in accordance with the following Indian Standards:

IS 8OO	General Construction in Steel
IS 816	Metal-arc welding for general construction in mild steel
IS 817	Training & Testing of metal-arc welders

9.1. Welding Electrodes

Welding electrodes shall comply with IS 814 and shall be chosen so as to produce welds with mechanical properties which are at least equal to those required for the base material. Welding electrodes shall be kept in a dry state in unbroken packets and shall be accompanied by the

manufacturer's certificate of date of manufacture and guarantee of compliance with IS 814 and the same shall not be used in a damp or damaged condition.

9.2. Welding Plant

Welding plant shall be capable of maintaining the voltage and current specified by the manufacturer of the electrodes. The Contractor shall supply instruments for verifying the voltage and current as and when required by the Engineer.

a. When an automatic process of welding is adopted, the deposited metal must have mechanical properties equal to those obtained by the use of electrodes complying with IS 814.

b. Manual Welding

Manual welding shall be carried out by qualified welders equipped with plant suitable for the purpose. All welders shall be qualified in accordance with IS 8171 and details of such qualification shall be submitted to the Engineer.

9.3. Welding Procedure and Trials

a. Before welding of any of the permanent works is carried out, the contractor shall furnish details of welding procedure for each welding operation.

b. Welding trials shall be carried out and completed on representative samples of the materials before the start of fabrication, as directed by the Engineer.

c. Welding trials are intended to establish welding procedure prior to the commencement of fabrication and for this purpose assemblies shall be made from plate or section cuttings large enough to simulate the joint selected for trial. The trial shall be representative of actual fabrication conditions including:

- c.1 Preparation and fit-up.
- c.2 Preheat.
- c.3 Welding position.
- c.4 Restraint (so far as is practicable)

d. Welding trials on material 2O mm thick will be taken to include all material under 2O mm thick and trials on material 4O mm thick to include material between 2O mm and 4O mm thick. The trials shall include specimen weld details from the actual construction which shall be welded in a manner simulating the most unfavourable instances of fit-up and preparation which it is expected will occur in the particular fabrication.

e. Assembly and welding shall be carried out in such a way to minimize distortion and residual stress and that the final dimensions are within appropriate tolerances.

f. The general welding program for shop and site welds, including particulars of the preparation of fusion faces, pre-heating where required and method of making welds shall be submitted in writing to the Engineer for approval before the work is put in hand. No departure from the welding program shall be made without the prior approval of the Engineer.

g. In the fabrication of built up assemblies all butt welds in each component part shall be completed before the final assembly. Wherever practicable, clamps, magnets, holding devices

or other setting-up fixtures shall be used in assembling parts of the structures so as to avoid tack-welding as far as possible.

h. In fit-ups where clamps cannot be used, spacer-strips shall be used to ensure the correct root gap.

i. Where tack welds are used, they shall be of the same quality and size as the first run of main weld. All tack welds shall be cleaned and ground to sound material prior to welding of the root pass. The main weld shall fuse completely with the end of the tack weld to form a regular

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k. profile. Where preheat is required for the main welds, the tack welds shall be made under the same heat conditions. The indiscriminate use of tack-welds during assembly shall be avoided.

l. All welds shall be visually inspected. Cracked or badly formed welds shall be cut out to the approval of the Engineer before re- welding them.

m. As far as practicable, all welding shall be carried out in the downhand position.

n. Where structural steelwork is painted before fabrication or erection, the metal surface within 75 mm of any weld shall be coated with primer only.

10. Supervision and Inspecting of Welding

10.1. The contractor shall appoint welding supervisors whose competence and qualifications shall be subject to the approval of the Engineer and all welding work shall be carried out under their direction.

10.2. The Contractor shall co-ordinate his activities so that all inspection work can be carried out before the removal of scaffolding and before the welds are covered by painting or field coating.

11. Criteria for Tests

The Contractor shall conduct tests in accordance with the following norms:

a. Visual examination - Hundred per cent (1OO%) of the welded joints.

b. Atleast 1O% welds shall be checked by dye-penetration test.

c. Atleast 4% welds shall be checked by Radiography tests.

Defective welding revealed by testing shall be made good to the satisfaction of the Engineer at the cost of the Contractor.

12. Painting

12.1. Painting shall be done in accordance with IS: 1477 (Part 1) and IS: 1477 (Part 2) with suggested primers, coatings, temporary coatings, permanent finishes etc. as the case may be.

12.2. All surfaces, which are to be painted, oiled or otherwise treated shall be dry and thoroughly cleaned to remove all loose scale and loose rust.

12.3. Shop contact surfaces need not be painted unless specified. If so specified, they shall be brought together while the paint is still wet.

12.4. Surfaces not in contact, but inaccessible after shop assembly, shall receive the full specified protective treatment before assembly. This does not apply to the interior of sealed hollow sections.

12.5. Chequered plates shall be painted but the details of painting shall be specified by the purchaser.

12.6. In case of surfaces to be welded, the steel shall not be painted or metal coated within a suitable distance of any edges to be welded if the paint specified or the metal coating would be harmful to welders or impair the quality of the welds.

12.7. Where two surfaces will be in permanent contact after assembly each of them shall receive, immediately before being assembled after being thoroughly scraped, one coat of red-lead

paint and surface shall be brought together while the paint is still wet. Welds and adjacent parent metal shall not be painted prior to deslagging, inspection and approval.

12.8. Steelwork which will be entirely embedded in concrete shall not to be painted but coated with two coats of Portland cement wash of the consistency of cream, the second coat being applied immediately prior to encasing.

12.9. Contact surface in friction type connection shall not be painted in advance.

13. Inspection before Erection

13.1. All fabricated members shall be inspected by the Engineer prior to erection. The Contractor shall be responsible for informing the Engineer as soon as any structural member is ready for inspection, and shall afford all the facilities necessary for inspection by the Engineer.

13.2. Any material or workmanship at any stage of construction, which in the opinion of the Engineer does not comply with the specified requirements, shall be rejected and not incorporated in the works.

14. Marking

14.1. Each piece of steel work shall be distinctly marked before dispatch in accordance with a marking diagram, and shall bear such other marks as will facilitate erection.

14.2. All structural steelwork members shall be clearly marked with an erection number. The Contractor shall show, on the fabrication Drawings, the positions, where the erection number is to be found and the method of marking it. Metal die-stamps shall not be used for making erection marks.

14.3. The Contractor shall be responsible for any delay caused in the program by rejection of any such Works.

15. Packing

All projecting plates or bars and all ends of members at joints shall be stiffened, all straight bars and plates shall be bundled, all screwed ends and machined surfaces shall be suitably packed and all rivets, bolts, nuts, washers and small loose parts shall be packed separately in cases, so as to prevent damage or distortion during transit.

C. ERECTION

1.0 General :

1.1. Erection of structural steelwork shall be carried out in accordance with the relevant IS Code in conformity with the drawings and specifications, in an expeditious manner.

1.2. The suitability and capacity of all plant, equipment etc, used for erection shall be to the satisfaction of the Engineer.

2. Scope of Erection Work

2.1. The Contractor shall provide all construction material and equipment, transport facilities, tools, tackles, consumables, labour, supervision for erection, including carrying out the following:

2.2. Receiving, unloading, checking and moving into the storage facility at site, as outlined under General Conditions of contract inclusive of attending to all Insurance matters in respect of materials arriving at site.

2.3. Transporting from site, storage, handling, rigging, assembling, riveting, bolting, welding, and installation of all fabricated materials in proper location according to drawings or as directed by the Engineer.

2.4. Checking centerlines, levels of all foundations blocks including checking line & level, position and plumb of all bolts and pockets. Any defect observed in the foundation shall be brought to the notice of the Engineer. The Contractor shall satisfy himself regarding the correctness of the foundations before installing the fabricated structures on the foundation blocks. Aligning, leveling, riveting, bolting, welding, fixing in position fabricated materials in accordance with drawings or as directed by the Engineer.

2.5. Supply of all required consumables, construction and erection materials, including but not limited to gauges, welding & brazing, rods, electrodes and wires, oxygen, acetylene, fuel, bolts, nuts, rivets, shims and temporary supports etc, as required for the incidental works and for the completion of erection.

2.6. Erection shall also include the following work:

2.6.1. All minor modification such as:

2.6.2. Removal of bends, kinks, twists etc of parts damaged during transport and handling.

2.6.3. Cutting, chipping, filling, grinding etc, for preparation and finishing of site connections.

2.6.4. Reaming for use of the next higher size of rivet or bolt for holes which do not register or which are found to be damaged.

2.6.5. Welding of connections in place of riveting or bolting for which holes are either not drilled or wrongly drilled during fabrication.

2.6.6. The following shall be considered as a legitimate part of erection work:

2.6.7. Re-fabrication work in respect of parts damaged beyond repair during transport and handling or in respect of those that are incorrectly fabricated.

2.6.8. Fabrication of parts omitted during fabrication due to an error, or subsequently found to be essential by client, architect, structural engineer, fabricator or by agency preparing the shop drawings.

2.6.9. Plug welding and re-drilling of holes which do not register and which cannot be reamed for the use of next size of rivet or bolt.

2.6.10. Drilling of holes which are either not drilled at all or are drilled in incorrect positions during fabrication.

2.6.11. Drilling of holes which are found necessary after completion of fabrication in shop or at site by client, architect, structural engineer, fabricator or by agency preparing the shop drawings.

3. Erection Drawings

3.1. The approved erection drawings and any approved arrangement drawings, specifications or instructions accompanying them shall be followed while erecting the structural steelwork.

Erection drawings for structural steelwork shall be prepared by the Contractor and shall consist of line-diagrams showing every member in position with the respective erection mark.

3.2. Erection marks shall appear on the structural steel members as detailed and all steelwork shall be erected with the marks in the same relative position as shown on the plan or elevation.

3.3. Any discrepancy between drawings and specifications shall be brought to the attention of the Engineer for obtaining his decision.

Storing and Handling of Material

3.4. The fabricated materials shall be carefully unloaded at site, examined for defects, checked, sorted out for each building and stacked properly above the ground level, to be kept clean and properly drained. The handling and storing of the component parts of a structure shall involve the use of method and appliances not likely to produce injury by twisting, bending or otherwise deforming the metal. No member slightly bent or twisted shall be put in place until the defects are corrected.

3.5. All small bends or twists detected in members shall be rectified before such members are put in place. Any serious bends or defects shall be reported at once to the Engineer. The straightening of bent edges of plates, angles and other shapes shall be done by methods not likely to produce fracture or other injury. Following the completion of the straightening of a bend or buckle, the surface of the metal shall be carefully inspected by the Contractor for evidence of incipient or any other type of fractures. The Contractor shall report to the Engineer about the presence of such evidence and act according to his instructions.

4. Setting Out

4.1. The Contractor shall be responsible for checking the alignment and levels of foundations, correctness of foundation-bolt centers, their projected height above the foundation tops, the length of threading provided and the provision and fitment of nuts for the foundation bolts. These shall be checked well in advance of starting the erection work and the Contractor shall be responsible for any consequences for non-compliance thereof. Discrepancies, if any, shall immediately be brought to the notice of the Engineer for his advice.

4.2. One set of reference axes and one Bench mark level will be furnished to the Contractor. These shall be used by him for the setting out operation.

4.3. The Contractor shall assume full responsibility for the correct setting out of all steelwork and erecting it correctly as per the alignment and levels shown on the drawings and for the verticality of members. Notwithstanding any assistance rendered to the Contractor by the Engineer, if at any time during the progress of the work any error should appear or arise therein, the Contractor shall remove and amend the work to the satisfaction of the Engineer, at his own cost.

5. Assembly and Erection

5.1. Before the commencement of structural steelwork, the Contractor shall submit a Schedule of Operations, detailing the erection procedures to be followed. The Schedule shall include provisions for any temporary bracing that may be considered necessary during the erection.

5.2. During the erection of a structure, the steelwork shall be securely bolted or otherwise fastened and if necessary temporarily braced, so as to make adequate provision for all erection stresses and conditions, including those due to erection equipment and its operation. Such temporary bracing shall be maintained in position until the erection work is sufficiently advanced, and it is ascertained that the bracing provided is no longer required.

5.3. Connections for temporary bracing and additional holes, members or cleats used to facilitate handling or erection, shall be provided in a manner which does not weaken the steelwork already erected. The alignment of each portion of the structure shall be carried out progressively, soon after that portion is erected. Permanent connections shall not be made until proper alignment has been obtained and a sufficiently large portion of the structure has been erected

and temporarily connected so as to ensure that the members thus connected shall not be overstressed or displaced during the progressive alignment of the remainder of the structure.

6. Site Erection

6.1. Plant and Equipment – The suitability and capacity of all plant and equipment used for erection shall be to the satisfaction of the engineer.

6.2. Storing and Handling – All structural steel should be so stored and handled at the site that the members are not subjected to excessive stresses and damage by corrosion due to exposure to environment.

6.3. Setting Out – The positioning and leveling of all steelwork, the plumbing of stanchions and the placing of every part of the structure with accuracy shall be in accordance with the approval drawings and to the satisfaction of the engineer in accordance with the deviation permitted below.

6.4. Erection Tolerances – The unloaded steel structure, as erected shall satisfy the criteria specified in Table 1 within the specified tolerance limits.

TABLE 1 NORMAL TOLERANCES AFTER ERECTION

Criterion	Permitted deviation
Deviation of distance between adjacent columns	5 mm
Inclination of a column in a multi-storey building between adjacent floor levels	0.002hs where hs is the storey height
Deviation of location of a column in a multi-storey building at any floor level from a vertical line through the intended location of the column base	$0.0035\sum hb/n0.5$ where $\sum hb$ is the total height from the base to the floor level concerned and n is the number of storeys from the base to the floor level concerned
Inclination of a column in a single storey building, (not supporting a crane gantry) other than a portal frame	0.0035hc where hc is the height of the column
Inclination of the column of a portal frame (not supporting a crane gantry)	Mean: 0.002hc Individual: 0.010hc

6.5. Each criterion given in the table shall be considered as a separate requirement, to be satisfied independently of any other tolerance criteria. The erection tolerances specified in Table 1 apply to the following reference points:

6.6. For a column, the actual centre point of the column at each floor level and at the base, excluding any base-plate or cap-plate. The level of the base plate on pedestal shall be so as to avoid to contact with the soil and corrosion environment

6.7. For a beam, the actual centre point of the top surface at each end of the beam, excluding any end-plate.

6.8. The straightness tolerances specified in Table 2 have been assumed in the derivation of the design stress for the relevant type of member. Where the curvature exceeds these values, shall be reviewed the effect of additional curvature on the design calculations shall be reviewed.

6.9. A tension member shall not deviate from its correct position relative to the members to which it is connected by more than 3 mm along any setting axis.

7. Clearances

7.1. The erection clearance for cleated ends of members connecting steel to steel should preferably be not greater than 2.0 mm at each end. The erection clearance at ends of beams without web cleats

should be not more than 3mm at each end. Where for practical reasons, greater clearance is necessary, suitably designed seatings should be provided.

7.2. In bearing type of connections, the holes may be made not more than 1.5 mm greater than the diameter of the bolts in case of bolts of diameter less than 25 mm and not more than 2 mm in case of bolts of diameter more than 25 mm, unless otherwise specified by the engineer. The hole diameter in base plates shall be not more than 6 mm greater than the anchor bolt diameter.

7.3. In friction type of connection the clearance may be maintained, unless specified otherwise in the design document.

8. Shop Erection

8.1. The steel work shall be temporarily shop erected complete or as arranged with the inspector so that accuracy of fit may be checked before dispatch. The parts shall be shop assembled with sufficient numbers of parallel drifts to bring and keep the parts in place.

8.2. In the case of parts drilled or punched, through steel jigs with bushes resulting in all similar parts being interchangeable, the steelwork may be shop erected in such position as arranged with the inspector.

8.3. In case of shop fabrication using numerically controlled machines controlled by data generalised by CAD software, the shop erection may be dispensed with at the discretion of the inspector.

9. Safety during Fabrication and Erection.

9.1. All steel materials including fabricated structures either at fabrication shop or at erection site shall be handed only by worker skilled in such jobs-where necessary with load tested lifting devices having tested wire rope slings of correct size, from damage. The devices should be well maintained and operated by experienced operators.

9.2. Oxygen and Acetylene cylinders and their hoses shall have distinctive colours. Cylinders should be stored in upright position in well-ventilated rooms or in open air-not exposed to flames, naked lights or extreme heat and should also be in upright position when they are being used. All gas cutting works shall be done only through experienced skilled gas cutters equipped with gloves, boots, aprons, googles and good cutting sets of approved make.

9.3. While doing any welding work, it should be ensured that the welding machine is earthed and the welding cables are free from damage. The welder and his assistant shall use a face shield or head shield with a welding lens and clear cover glass and their hands legs and bodies shall be well protected by leather gloves, shoes and aprons. Combustible materials should be kept away from the sparks and globules of molten metals generated in any arc welding. In case of

welding in a confined place, it should be provided with an exhaust system to take care of the harmful gases, fumes and dusts generated.

9.4. In addition to precautions against all the hazards mentioned above, erection workers shall be protected in the following manner:

9.5. All workers must wear helmets and should also be provided with gloves and shoes. In addition those working at heights shall be forced to use safety belts.

9.6. All structures should be so braced/guyed during erection that there is no possibility of collapse before erection work is completed.

9.7. Warning signs such as “Danger”, “Caution”, “440 volts”, “Don not smoke”, “Look ahead” etc. should be displayed at appropriate places

9.8. For detailed safety precautions during erection, reference shall be made to IS: 7205.

10. Field Connections

10.1. Field riveting – Rivets driven at the site shall be heated and driven with the same care as those driven in the shop.

10.2. Field bolting – Field bolting shall be carried out with the same care as required for shop bolting.

10.3. Fillet welding – All field assembly and welding shall be executed in accordance with the requirements for shop fabrications excepting such as manifestly apply to shop conditions only. Where the steel has been delivered painted, the paint shall be removed before field welding for a distance of at least 50 mm on either side of the joint.

11. Bedding Requirement

11.1. Bedding shall be carried out with Portland cement grout or mortar, as described under 15.4 or fine cement concrete in accordance with IS: 456

11.2. For multi-storeyed buildings, this operation shall not be carried out until a sufficient number of bottom lengths of stanchions have been properly lined, leveled and plumbed and sufficient floor beams are in position.

11.3. Whatever method is employed the operation shall not be carried out until the steelwork has been finally leveled and plumbed, stanchion bases being supported meanwhile by steel wedges or nuts; and immediately before grouting, the space under the steel shall be thoroughly cleaned.

11.4. Bedding of structure shall be carried out with grout or mortar, which shall be of adequate strength and shall completely fill the space to be grouted and shall either be placed under pressure or by ramming against fixed supports. The grouts or mortar used shall be non-shrinking variety.

12. Tolerances

12.1. Erection tolerances shall be provided strictly in accordance with the requirements of IS 7215.

TABLE 2 STRAIGHTNESS TOLERANCES INCORPORATED IN DESIGN RULES

Criterion	Permitted deviation
Straightness of a column (or other compression member) between points which will be laterally restrained on completion of erection	0.001L generally 0.002L for members with hollow cross-sections where L is the length between points which will be laterally restrained
Straightness of a compression flange of a beam, relative to the weak axis, between points, which will be laterally restrained on completion of erection.	0.001L generally 0.002L for members with hollow cross-sections where L is the length between points which will be laterally restrained

13. Maintenance

13.1. **General** – Where steelwork is to be encased in solid concrete, brickwork or masonry, the question of maintenance should not arise, but where steelwork is to be housed in hollow fire protection or is to be unprotected, particularly where the steelwork is exposed to a corroding agent, the question of painting or protective treatment of the steelwork should be given careful consideration at the construction stage, having regard to the special circumstances of the case.

13.2. Connections – Where connections are exposed to a corroding agent, they should be periodically inspected, and any corroded parts should be thoroughly cleaned and painted.

13.3. Where bolted connections are not solidly encased and are subject to vibratory effects of machinery or plant, they should be periodically inspected and all bolts tightened.

14. Painting after Erection

14.1. Before painting of such steel, which is delivered unpainted, is commenced, all surfaces to be painted shall be dry and thoroughly cleaned from all loose scale and rust, as required by the surface protection specification.

14.2. The specified protective treatment shall be completed after erection. All rivet and bolt heads and the site welds after de-slagging shall be cleaned. Damaged or deteriorated paint surfaces shall first be made good with the same type of paint as the shop coat. Where specified, surfaces, which will be in contact after site assembly, shall receive a coat of paint (in addition to any shop priming) and shall be brought together while the paint is still wet. No painting be used on contact surfaces in the friction connection, unless specified otherwise by the design document.

14.3. Where the steel has received a metal coating in the shop, this coating shall be completed on site so as to be continuous over any welds and site rivets or bolts, but subject to the approval of the engineer. Painting on site may complete protection. Bolts, which have been galvanized or similarly treated, are exempted from this requirement.

14.4. Surface, which will be inaccessible after site assembly shall, receive the full-specified protective treatment before assembly.

14.5. Site painting should not be done in frosty or foggy weather, or when humidity is such as to cause condensation on the surfaces to be painted.

15. Tolerances

15.1. References may be made to IS: 7215, ‘Indian Standard tolerances for erection of steel structures’, and the Handbook for fabrication, erection and inspection of steel structures’ for general guidance.

15.2. Tolerances for fabrication of steel structures shall conform to IS:7215. Tolerances for erection of steel structures shall conform to the relevant Indian Standard (IS: 12843) and Handbook for

Fabrication, Erection, Painting and Inspection of Steel Structures. For general guidance on fabrication by welding, reference may be made to IS: 9595.

D. INSPECTION AND TESTING

1. The inspector shall have free access at all reasonable times to those parts of the manufacturer's works which are concerned with the fabrication of the steelwork and shall be afforded all reasonable facilities for satisfying himself that the fabrication is being undertaken in accordance with the provisions of this standard.
2. Unless specified otherwise, inspection shall be made at the place of manufacture prior to dispatch and shall be conducted so as not to interfere unnecessarily with the operation of the work.
3. The manufacturer shall guarantee compliance with the provisions of this standard, if required to do so by the purchaser.
4. Should any structure or part of a structure be found not to comply with any of the provisions of this standard, it shall be liable to rejection. No structure or part of the structure, once rejected shall be resubmitted for test, except in cases where the purchaser or his authorized representative considers the defect as rectifiable.
5. To facilitate inspection, the contractor should during all working hours, have a foreman or properly accredited charge hand available on the site, together with a complete set of contract drawings and any further drawings and instructions which may have been issued from time to time.
6. Defects, which may appear during fabrication, shall be made good with the consent of and according to the procedure laid down by the inspector.
7. All gauges and templates necessary to satisfy the inspector shall be supplied by the manufacturer. The inspector, may, at his discretion, check the test results obtained at the manufacturer's works by independent tests at the Government Test House or elsewhere, and should the material so tested be found to be unsatisfactory, the costs of such tests shall be borne by the manufacturer, and if satisfactory, the costs shall be borne by the purchaser.

E. CHECKLIST FOR STEELWORK INSPECTION

The inspector shall ensure that the following points are complied with and should tick √ or X against each checklist item.

1. Drawings and Documents

1.1. Relevant architectural drawings are present on the site.

1.2. Relevant structural drawings for reference are present on the site.

1.3. Relevant approved Fabrication drawings are present on the site.

1.4. Document related to methodology of fabrication and erection is present on the site

1.5. Weld preparation detail is present on the site (if stated specifically in the methodology)

2. Materials

2.1. Copies of test certificates for the materials to be used are present on the site.

2.2. Test results are satisfactory

2.3. All members to be used in the fabrication are straight.

2.4. All members to be used in the fabrication are free from defects such as

a. pitting

b. rust

c. twists

d. cracks

e. surface flaws

f. lamination

g. imperfect edges

h. any other defects.

3. Storage of materials

3.1. All material is stored properly on a raised platform.

3.2. It is kept clean and properly drained.

3.3. Structural steel is so stored and handled that members are not subjected to excessive stresses and damage.

4. Fabrication

4.1. Fabrication is taking place in Workshop / Site

4.2. Are fabrication parts numbered for erection purpose?

4.3. Are templates / jigs being used to fabricate all similar parts?

4.4. Template / jig dimensions checked and found satisfactory.

4.5. The dimensional accuracy of the members is within 2 mm at each end.

4.6. Which method is used for cutting the members ? Saw cutting / Flame Cutting

4.7. Are the edges of the cut members being ground to a depth of 2 to 3 mm ?

4.8. In case of butt joints and full bearing surfaces, the cut edges / machined surfaces are in full contact.

4.9. All cut edges are perfectly perpendicular to their surfaces unless specifically mentioned otherwise in the drawings.

4.10. Holes for bolts are made by drilling / gas cutting (Reject gas cut holes)

4.11. Has a trial assembly been made on the ground before proceeding to erection?

5. Welding

5.1. Are qualified welders present on the site?

5.2. Welder's qualification certificate is available with the fabricator ? Seen / Not seen

5.3. Welding electrodes seen and confirmed as complying with IS 814 or equivalent

5.4. Welding procedure document is available on site.

DATE : _____

TIME : _____

5.5. Is all welding complete before erection of member in place?

5.6. Are clamps being used during welding to avoid warping of members?

5.7. Are spacers being used to ensure correct root gap?

5.8. Are tack welds being used for initial fit out before carrying out full welding ?

5.9. Are thicker members being pre-heated to required temperatures before welding ?

5.10. Are welding rods being de-moisturized in an oven before using them for welding ?

5.11. Is there a case of overhead welding ?

5.12. Is a welding supervisor present on the site ?

5.13. Results of 100 % visual inspection of the welds - Satisfactory / correction required

5.14. Results of 10% welds tested with dye-penetration test – Satisfactory / Correction required

5.15. Is radiography test recommended by designer ?

5.16. Results of radiography tests – Satisfactory / rejected

6. Painting

6.1. Surface cleaning carried out before painting with primer.

6.2. Steel work to be embedded in concrete is not painted. If painted, should be completely cleaned and bare surface to be exposed.

7. Erection

7.1. Checking centerlines, levels of all foundations blocks including checking line & level, position and plumb of all bolts and pockets.

7.2. Is Re-fabrication work in respect of parts damaged beyond repair during transport and handling or in respect of those that are incorrectly fabricated required ?

7.3. Are the members being stressed, bent after erection?

7.4. Adequate lifting and positioning equipment is available on the site?

7.5. Is there an erection procedure document on the site ?

7.6. Are all members painted with primer before erection ?

7.7. Is temporary bracing suggested by designer in the methodology of erection ? Has it been provided at site ?

7.8. Proper alignment has been done prior to permanent connections ?

7.9. Are all bolts tightened ?

7.10. Are all connections fully welded after erection wherever specified in drawings ?

Project Reference : _____

Structure Reference : _____

Name of the inspector : _____

Representing : M/s _____

Designation : _____ Signature : _____

Inspection carried out in the presence of : _____

Representing : M/s _____

Designation : _____ Signature : _____

Reference Drawing Nos.

Architectural : _____ Structural : _____

Fabrication Drawing : _____Erection Drawing : _____

IV : SPECIFICATION FOR FLOORING WORK

(Applicable for all Items of work as per BOQ Ref Item No II (5) & IV (5) (6))

C O N T E N T S

9.1 LIST OF MANDATORY TESTS

Material	*Clause*	*Test*	*Field/ Laboratory Test*	*Test Procedure*	*Minimum quantity of material/ work for carrying out the test*	*Frequency of testing*
Marble	8.3 (Table 8.2)	(i) Moisture Absorption	Laboratory	IS 1124	50 Sqm.	100 Sqm. Or part thereof.
		(ii) Hardness Test	-do-	Mho's Scale	-do-	-do-
		(iii) Specific Gravity	-do-	IS 1122	-do-	-do-
Granite		(i) Moisture	-do-	IS 1124	-do-	-do-
		(ii) Specific Gravity	-do-	IS 1122	-do-	-do-

9.2 LIST OF BUREAU OF INDIAN STANDARDS CODES

S. No.	**IS. No.**	**Subject**
1.	IS 1122	Method of test for determination of true specific gravity of natural building stones.
2.	IS 1124	Method of test for determination of water absorption, apparent Specific gravity and porosity of natural building stones.
3.	IS 1130	Marble (blocks, slabs and tiles).
4.	IS 4101 (Part 1)	Code of practice for external facing and veneers: Stone facing.
5.	IS 3316	Specifications for structural granite
6.	IS 14223 (Part 1)	Polished Building Stones (Part-1) Granite

9.4.0 Granite Stone

It shall be of any colour and size as directed by Architect / Project Manager . Granite shall be plain machine cut and mirror polished. The stone shall be smooth and of even surface without holes or pits.

9.4.2 SIZES AND TOLERANCES

The size of marble blocks, slabs and tiles shall be as mentioned in Table 8.1.

TABLE 8.1

		Length	Width	Thickness
1.	Blocks	30 to 250	30 to 100	30 to 90
2.	Slabs	70 to 250	30 to 100	2 to 15
3.	Tiles	10 to 60	10 to 60	0.8 to 2.4

Notes:

1. All dimensions are in centimeter.
2. The length and width, of the blocks shall be in multiple of 30 cm.
3. Length and width of slab shall be in multiple of 10 cm. and thickness in multiple of 1 cm.
4. Tiles shall be square cut and linear dimensions in multiple of 10 cm.
5. Only slabs and tiles shall be machine cut and factory made.

6. For 8 mm thick tiles, special precautions will be required for fixing them like using special adhesive as per manufacturer's specifications. Such tiles are not suitable for outside veneering work exposed to rains/sun if used in large areas in continuous stretches. For tiles of thickness 20 mm and above cramps may be provided if approved by Architect / Project Manager .

Tolerance

The following tolerances shall be allowed in the dimension of blocks, slabs and tiles:

Blocks	Tolerance
(a) Length	+ 2 per cent
(b) Width	+ 2 per cent
(c) Thickness	+ 2 per cent
Slabs	
(a) Length	+ 2 per cent
(b) Width	+ 2 per cent
(c) Thickness	+ 3 per cent
Tiles	
(a) Linear dimension	+ 3 per cent
(b) Thickness	+ 1 per cent

The sizes other than those mentioned above may be provided as directed by the Architect / Project Manager and nothing extra shall be payable on this account.

9.4.3 PHYSICAL PROPERTIES

9.4.3.1 The physical properties of marble for blocks, slabs and tiles and method of tests are mentioned in Table 8.2.

TABLE 8.2

Characteristic	Marble Requirements	Method of test	Granite Requirement	Method of test
(1) Moisture absorption after 24 hrs immersion in Cold water	Max. 0.4%	IS 1124 by weight	Max. 0.50%	IS 1124
(2) Hardness	Min. 3	Mhos scale		
(3) Specific Gravity	Min. 2.5	IS 1122	Min. 2.6	IS 1122

9.4.3.2 Approval of Sample

Before starting the work, the contractor shall get samples of marble approved by the Architect / Project Manager . Approved samples shall be kept in the custody of the Architect / Project Manager and the marble supplied and used on the work shall conform to samples with regard to soundness, colour, veining and general texture.

9.4.4 SAMPLING

In any consignment all the blocks/slabs/tiles of the same group, size and finish shall be grouped together to constitute a lot. Sample shall be selected and tested separately for each lot for determining its conformity or otherwise to the requirements of the specification. The number of blocks/slabs/tiles to be selected for the samples shall depend upon the size of the lot and shall be in accordance with the Table 8.3.

TABLE 8.3

Sample Size and Criteria for Conformity

Number of Blocks slabs/Tiles in the lot	Number of blocks slabs/ Tiles to be selected in sample	Permissible number of defectives	Sub sample size	in no.
(1)	(2)	(3)	(4)	

Up to 25	3	0	2
26 to 100	5	0	2
101 to 200	8	0	3
201 to 500	13	0	4
501 to 1000	20	1	5

Note: The blocks/slabs/tiles in the sample shall be taken at random and in order to ensure to randomness of selection, random tables may be used.

Explanation 1 : All the blocks/slabs/tiles, selected in the sample, shall be examined for dimensions workmanship and general requirements.

Any block/slab/tile failing in any one or more of the above requirements shall be considered as defective.

A lot shall be considered as conforming to these requirements if the number of defectives obtained is not more than permissible no. of defectives given in Col. 3 of table 8.3

Explanation 2 : The lot having been found satisfactory with respect to dimensions, workmanship and general requirement shall be tested for physical properties of the marble. For this purpose a sub sample of the size given in Col. 4 of Table 8.3 shall be selected at random. These blocks/slabs/tiles in the sub sample shall be tested for moisture absorption, hardness and specified gravity. The lot shall be considered having satisfied the requirements of the physical properties if none of the blocks/slabs/tiles tested for the requirements fails in any of these tests.

9.4.5 MARBLE WORK - TABLE RUBBED AND POLISHED (PLAIN WORK)
Marble work in steps, jambs, columns and other plain work shall be as specified below:

Joints in staircase treads, kitchen platforms shall be permitted only at curvature or when width/length is more than 0.6/2 Mtrs. respectively. Number of joints in each direction shall not be more than one number for every 2 Mtrs. length beyond the initial 2.00 m length. Additional joints due to curvature or for providing fixture shall be provide judiciously as given in sketch ‘A’ below.

9.4.5.1 Dressing, Cutting and Rubbing
Every marble stone shall be gang saw/machine cut to the required size and shape, chisel dressed machine finished on all beds and joints, so as to be free from any waviness and to give truly vertical, horizontal, radial or circular joints as required. The exposed faces and sides of stones forming joints upto 6mm. from the face shall be fine tooled machine cut such that a straight edge laid along the face of the stone is in contact with every point on it. All window sills, tread of steps, counters vanities moulding edges etc. shall be machine cut & polished to give high gloss mirror finish as per direction of Architect / Project Manager . These surfaces shall then be rubbed smooth. All visible angles and edges shall be true, square and free from chipping. Beyond the depth of 6 mm from face, the joints shall be dressed with a slight splay so that the thickness of joint increases, in an inverted V shape as shown in Fig. below. The surfaces of the stones coming in contact with backing need not be chisel dressed.

INVERTED V-SHAPE JOINT
A sample of dressed and rubbed stone shall be prepared for approval and it shall be kept on worksite after being approved by the Engineer-in Charge.

9.4.5.2 Mortar
The mortar used for jointing shall be as specified.

9.4.5.3 Laying

All marble stones shall be wetted before placing in position. These shall then be floated on mortar and bedded properly in position with wooden mallets without the use of chips or under pinning of any sort.

The walls and pillars shall be carried up truly in plumb or battered as shown in the drawings. All courses shall be laid truly horizontal and all vertical joints shall be truly vertical.

In case of work without backing of brick work or coursed rubble masonry, face stone shall be laid in headers and stretchers alternatively unless otherwise directed. The headers shall be arranged to come as nearly as possible in the middle of stretchers above and below. Stone shall be laid in regular courses of not less than 15 cm in height and all courses shall be of the same height unless otherwise specified.

For work facing with backing of brick work or coursed rubble masonry, face stone shall be laid in alternate courses of header and stretchers unless otherwise directed. Face stone and bond stone courses shall have break joint on the face of atleast half the height of the standard course and the bond shall be carefully maintained through out. All the connected masonry in a structure shall be carried up nearly at one uniform level throughout but where breaks are unavoidable the joints shall be made in good long steps so as to prevent cracks developing between new and old work.

When necessary jib crane or other mechanical appliances shall be used to hoist the heavy pieces of stones and place these in to correct positions, care being taken that the corners of the stone are not damaged. Stone shall be covered with gunny bags, before putting chain or rope is passed over it, and it shall be handled carefully. No piece which has been damaged shall be used in work. The matching of grains shall be carried out as directed by the Architect / Project Manager .

9.4.5.4 Bond Stone

Bond or through stones running right through the thickness of walls, shall be provided in walls upto 60 cm thick and in case of wall above 60 cm thickness a set of two or more bond stones overlapping each other by atleast 15 cm shall be provided in a line from face to back.

At least one bond stone or a set of bond stones shall be provided for every 0.5 Sqm of the wall surface. All bond stones shall be marked suitably as directed by the Architect / Project Manager .

9.4.5.5 Joints

The depth of joints 6 mm from the face shall be uniform and as fine as possible but shall be not more than 1.5 mm thick on the exposed face. Beyond the depth of 6 mm from face, the thickness of joints shall increase in an inverted V shape so as to give good mortar bond between two stones. The inverted portion of the joints shall be filled with bedding mortar and the face 6 mm portion with pointing mortar.

9.4.5.6 Curing

The work shall be kept constantly moist on all faces for a period of atleast seven days.

9.4.5.7 Finishing

After the marble work is cured, it shall be rubbed with carborandum stone of different grades no. 60, 120 and 320 in succession or with electrical rubbing machines rubbed with carborandum items 0 to 6 nos. in succession, so as to give a plane true and highly smooth surface. It shall then be cleaned with a solution of oxalic acid, washed and finished clean.

9.4.5.8 Protection

Green work shall be protected from rain by suitable coverings. The work shall also be suitably protected from damage during construction.

9.4.5.9 Scaffolding

Double scaffolding having two sets of vertical supports shall be provided where necessary. The supports shall be sound and strong, tied together by horizontal pieces over which the scaffolding plank shall be fixed.

9.4.5.10 Tolerances

As per Para 9.4.2

Note: The above Para 9.4.5. also applies to the Ashlars masonry referred in Stone Work specifications.

9.4.5.11 Measurements

For plain work: Measurements shall be taken correct to a cm in length and breadth and correct to 0.5 cm in thickness.

9.4.5.11.1 In the case of radially dressed or circular stone used in the work, the dimensions of the circumscribing rectangle of the dressed stone, shall be measured correct to a centimeter and thickness, correct to 0.5 cm.

The cubical contents shall be calculated in cubic decimeter nearest to two places of decimal.

9.4.5.11.2 The marble work in arches and domes shall be measured as for plain work, but extra shall be allowed for such work over the rate for plain work.

9.4.5.11.3 Sunk or moulded work in marble shall be measured by volume as per plain marble work or work in arches or domes as the case may be on the basis of circumscribed rectangular block of the finished work but extra shall be paid for such work over the rate for plain work for work in arches and domes. For the purpose of extra payment, volume of every stone sunk or moulded shall be considered.

9.4.5.12 Rate

The rate includes the cost of materials and labour required for all the operations i/c cutting of recesses in wall cutting moulding corners edge rounding finishing & polishing as specified.

9.4.5.13 Use of Finished Marble Slabs and Tiles

In case such finished tiles are used, these shall be measured and paid for separately.

9.4.6 WALL LINING/VENEER WORK

9.4.6.1 Unless and otherwise specified in the nomenclature of the item, the marble slabs used for wall lining/veneer work shall be gang saw cut (polished & machine cut) and conform to dimensions given in Table 8.1 above.

Back shall not be polished/ cut in order to ensure a good grip with the hearting of backing. The cut slabs shall be of the thickness as specified with a tolerance permissible under Para 9.4.2 above. The tolerance in wall lining when straight edge of 3 m length is placed should not be more than 2 mm.

9.4.6.2 Laying

The stone shall be wetted before laying. They shall then be fixed with mortar in position without the use of chips or under pinning of any sort. Care shall be taken to match the grains of veneer work as directed by the Architect / Project Manager . For purpose of matching the grains, the marble slabs shall be selected judiciously having uniform pattern of veins/streaks. Preferably the slabs shall be those got out of the same block from the quarry. The area to be veneered shall be reproduced on the ground and the marble slabs laid in position and arranged in the manner to give the desired matching of grains. Any adjustment needed for achieving the best results shall be then carried out by replacing or interchanging the particular slabs. Special care shall be taken to achieve the continuity of grains between the two slabs one above the other along the horizontal joints. This shall then be got approved by the Architect / Project Manager and each marble slabs numbered properly and the same number shall be marked on a separate drawing as well as on the surface to be actually veneered, so as to ensure the fixing of the particular slabs in the correct location.

For the facing of the columns also the same procedure as mentioned above shall be followed.

9.4.6.2.1 Where so desired, the adjoining stones shall be secured to each other by means of pins as specified.

9.4.6.2.2 The stones shall be secured to the backing by means of cramps. The material for cramps shall have high resistance to corrosion under conditions of dampness and against the chemical action of mortar or concrete in which cramps are usually embedded.

Cramps shall be of as specified in case of backing of stone masonry walls and brick masonry walls thicker than 230 mm. In case of backing with brick masonry walls 230 mm or less thick or RCC members cramps shall be of specified length as per requirement made out of gun metal or any other metal specified in design by consultants. Generally the outer length of cramp, typical shape & details of cramps for such backing are as indicated in drawings for general guidance. This can be modified as per the approved shop drawings as directed by the Architect / Project Manager if so, required at site. Cramps shall be spaced not more 60 cm apart horizontally.

9.4.6.2.3 The adjoining stones shall be secured to each other by means of cramps or pins of the specified size. Cramps may be attached to its sides or top and bottom or sides, top and bottom. The general arrangement of cramps required for fixing facing unit to the wall are as mentioned in approved shop drawing. The actual number of cramps and their sections, however, shall be as per requirements of design to carry the loads.

9.4.6.2.4 Where cramps are used to hold the unit in position only, the facings shall be provided with a continuous support on which the stones rest at the ground level and other storey levels, the support being in the form of projection from or recess into the concrete floor slab, or a beam between the columns or a metal angle attached to the floor slab or beams. These supports shall preferably be at vertical intervals not more than 3.5 m apart and also over the heads of all openings. Such supports shall also be provided where there is transition from thin facing below to thick facings above.

9.4.6.2.5 Alternatively cramps may be used to hold the units in position and in addition to support the units thus transferring the weight of the units to the backing. Such cramps should be properly designed as per IS 4101 (Part 1).

9.4.6.2.6 The cramps may be of copper alloyed with zinc, tin, nickel, lead or stainless steel.

9.4.6.2.7 The pins, cramps and dowels shall be laid in cement mortar 1:2 (1 cement : 2 fine sand) and their samples got approved by the Architect / Project Manager and kept at site.

9.4.6.3 Joints

All joints shall be full of mortar. Special care shall be taken to see that groundings for veneer work are full of mortar. If any hollow groundings are detected by tapping the face stones, these shall be taken out and re-laid. The thickness of the face joints shall be uniform, straight and as fine as possible, not more than 1.5 mm and in the face joint, the top 6 mm depth shall be filled with mortar specified for the pointing.

9.4.6.4 Mortar

The mortar used for jointing slabs shall be as specified.

9.4.6.5 Curing, Finishing, Protection and Scaffolding

It shall be as specified under 9.4.5.6, 9.4.5.7, 9.4.5.8 and 9.4.5.9.

9.4.6.6 Measurements

The length and breadth shall be measured correct to a cm. In case of radially dressed or circular slabs used in the work, the dimensions of the circumscribing rectangles of the dressed stone used in the work, shall be measured & paid for. The area shall be calculated in Sqm nearest to two places of decimal.

Marble work in lining upto 4 cm thickness shall be paid by area under veneer work and lining of greater thickness paid by volume under plain marble work.

9.4.6.7 Rate

The rate includes the cost of materials and labour required for all the operations described above except for the cost of providing and fixing of dowel and cramps which shall be paid for separately, unless otherwise stipulated in the item of work.

When factory made finished slabs and tiles are used, no further finishing as mentioned in Para 8.5.7 shall be required nor anything extra shall be payable.

The specifications for marble/granite stone work, in general, shall be as specified. The marble granite stone shall be cut into slabs of required thickness and shall be one piece as per the detailed drawing.

9.4.7.1 Finishing

The partition of the slab to be embedded in the masonry shall be rough dressed. Dressing and rubbing of the exposed portion of the slab shall be as described. The dressed slab shall be of the thickness as specified with a tolerance of + 1.5mm. The slab shall be got approved from the Architect / Project Manager before fixing.

9.4.7.2 Fixing shall be as specified except that the recess shall be 7.5 cm wide. Fixing shall be done by cutting chase with chase cutter/fine tools in a recess of 7.5 cm X 7.5 cm filled with cement concrete 1:2:4 (1 cement : 2 coarse sand : 4 graded stone aggregate 6mm nominal size). Fixing can also be done by epoxy grout in a chase of 2.0 X 7.5 cm as per direction of Architect / Project Manager .

9.4.7.3 Rate shall include the cost of labour and materials involved in all the operations described above including the leaving/cutting of recess in the wall, moulding, curves, edge rounding, finishing and polishing as specified.

9.5.0 SPECIFICATION FOR GRANITE / ANTIQUE FINISH FLOORING, TREADS, RISERS, SILLS, CLADDING, DADO

9.5.1.0 STONE SLABS :

9.5.1.1 The colour and quality of marble slabs shall be of the kind of marble specified in item/drawings/as directed by the Project Manager. The marble from which the slabs are made, shall be of selected quality, hard, sound, dense and homogenous in texture, free from cracks, decay, weathering and flaws. Before starting the work, the contractor shall get the samples of marble slabs approved by the Project Manager. All slabs which goes into work shall strictly conform to the samples, failing which the entire materials are likely to be rejected.

The slabs shall be machine polished and machine cut to the dimensions specified in items of schedules of quantities/drawings and as directed by the Project Manager.

9.5.2 DRESSING OF SLABS:

9.5.2.1 Every stone shall be cut to the required size and shape, fine dressed on all sides to the full depth so that a straight edge laid along the side of the stone is full in contact with it. The top surface shall also be fine dressed to remove all waviness. The top surface of slabs shall be machine polished and exposed edges machine cut, or as specified in the item and as directed by the Project Manager. All visible angles and edges of the slabs shall be true, square or as required, and free from chippings and the surface shall be true and plane.

9.5.2.2 The thickness of the slabs shall be specified in the description of item. The minimum size of stone to be used for various items shall be as mentioned in the schedule of quantities/drawings of this tender. Marble stones of approved smaller sizes other than mentioned in the schedule of quantities, if required for bands, borders, flooring etc. shall be provided and laid as directed by the Project Manager.

Any opening of required size and shape at any desired place in flooring, bands, borders etc. shall be made in such a way that marble bounded by number of marble stones/slabs. No broken or defaced stone shall be permitted in the work.

9.5.3.0 BEDDING/BACKING MORTAR:

9.5.3.1 The bedding/backing shall be of cement mortar/lime mortar of mix and thickness as specified in the description of the item.

9.5.3.1.1 Mixing: The mixing of mortar shall be done in mechanical mixer or hand mixing as specified/as directed by the Project Manager.

9.5.3.1.1.1 Mixing in Mechanical Mixer : Cement and sand in the specified proportion shall be mixed dry thoroughly in a mixer. Water shall then be added gradually and wet mixing continued for at least one minute. Care shall be taken not to add more water than that which shall bring the mortar to the consistency of stiff paste.

9.5.3.1.1.2 Only the quantity of mortar, which can be used within 30 minutes of its mixing shall be prepared at a time.

9.5.3.1.1.3 Mixer shall be cleaned with water each time, before suspending the work.

9.5.3.1.2 Hand Mixing : If approved by Project Manager, hand mixing shall be allowed. The measured quantity of sand shall be leveled on clean masonry platform and cement bags emptied on top. In hand mixing, the quantity of cement shall be increased by 5% over the approved constant, with no extra cost to the Department. The cement and sand shall be thoroughly mixed dry by being turned over and over, backwards and forwards, several times till the mixture gives an uniform colour. The quantity or dry mix which can be used within 30 minutes shall then be mixed on masonry through with just sufficient quantity of water to bring the mortar to the consistency of stiff paste.

General : Mortar shall be used as soon as possible after mixing and before it has begun to set, and in any case within 30 minutes after the water is added to the dry mixture. Mortar unused for more than 30 minutes shall be rejected and removed from the site of work immediately.

9.5.4.0 LAYING - FLOORING:

9.5.4.1 Before laying the cement mortar bedding/backing, the concrete/brick, floor/wall surfaces shall be thoroughly hacked, cleaned of all mortar scales, concrete lumps etc., brushed, washed with water to remove mud, dirt etc. from the surface and shall be thoroughly wetted. Until and unless the surface is approved by the Project Manager, the flooring shall not be started. A bedding of cement mortar of 20 mm. average thickness with the minimum thickness at any place under the slab not less than 13mm. shall be laid evenly and to the required slopes as directed / specified. The marble slabs shall be thoroughly washed and cleaned and then be laid on the bedding/ backing with cement floating at the rate of 4.39 kg./sqcm. All slabs shall be truly and evenly set in a thick cement slurry or paste like consistency applied to the sides and bottom and over the prepared base. The slabs shall then be tamped down with a wooden mallet until they are exactly in true plane and line with adjacent slabs. All slabs shall be extended upto the unplastered surface of masonry walls/RCC columns/RCC walls. The slabs shall be close jointed in matching cement slurry and the cement slurry coming out through the thin joints shall be immediately wiped clean. The grains of marble stone shall be matched as shown in drawing or as directed by the Project Manager. All slabs shall be so laid as to have continuous lines from various rooms to the corridors. No change of lines shall be permitted at junction between rooms and corridor, if the same flooring is specified in both the places.

9.5.5.0 MARBLE SILLS, TREADS ETC. :

9.5.5.1 Marble stone for sills shall be of approved quality. Dressing of stone slab, mortar mix. for bedding/backing, laying etc. shall be similar to as described above as far as applicable. Marble slabs of specified thickness and width shall only be provided. The length of the each slab required for the sill shall be of the pattern which shall coincide with the lines of the mullions of windows where it is laid or as directed by the Project Manager. Normally it shall not be less than 1.0 m. length.

9.5.6.0 MARBLE STONE DADO & CLADDING :

9.5.6.1 Only machine cut and machine polished marble stone will be used. Brass cramps and brass pins of approved quality, size and make shall be provided. The brass pins shall be provided at the meeting of two marble slabs both ways horizontally and vertically. The brass cramps shall be provided at the places approved by the Project Manager. Marble to be used shall be of approved size, colour, type of veins and laid as specified in schedule of quantities or to the pattern shown in drawings or as directed by the Project Manager. Laying of marble stone shall be similar as stated above as far as applicable.

9.5.7.0 POLISHING AND FINISHING :

9.5.7.1 The polishing and finishing shall be carried out in the similar manner as specified under the chapter "TERRAZZO/CEMENT TILES FLOORING, SKIRTING/DADO ETC." as far as it is applicable.

9.5.8.0 MEASUREMENT :

9.5.8.1 Marble stone flooring, sills, treads, risers, dado cladding etc. shall be measured in square meter correct to two places of decimal. The length and breadth shall be measured between the finished faces correct to two places of decimal of meter. No deduction shall be made nor extra paid for any opening of area upto 0.05 Sqm. Nothing extra shall be paid for working at different levels.

NOTE : Wastage in marble slab cutting to get the required dimensions, as specified in drawing or as directed by the Project Manager shall be deemed to be considered by the contractor while quoting the rate for work. The work shall be measured as above and no extra claim will be entertained on this account.

9.5.9.0 RATE :

The rate shall include the cost of all materials, transport tools, plants, scaffolding and labour involved in all operations described above.

9.5.10.0 GRANITE STONE FLOORING, TREADS, RISERS, SILLS, CLADDING, DADO ETC. :

9.5.10.1 The specifications mentioned for Marble stone flooring shall be generally applicable for this item. In case of granite stones available in different shades, the samples shall be submitted for approval of Project Manager.

9.7.0 SPECIFICATIONS FOR VITRIFIED TILE FLOORING, DADO / SKIRTING / FACIA

9.7.1 MATERIALS:

Vitrified Tiles: The tiles shall be of approved make and shall generally conform to the approved standards. They shall be flat and true to shape, free from cracks, crazing spots, chipped edges and corners. Unless otherwise specified, the nominal sizes of tiles shall be as under:

The tiles shall be square or rectangular of nominal sizes such as: 600 x 600 mm; 900 x 900 mm or as per tender schedule / drawings or as directed by the Project Manager. Thickness shall be as per recommendations of the approved manufacturers.

Technical specifications of the tiles shall be generally conforming to the following standards:

TECHNICAL SPECIFICATIONS FOR VITRIFIED TILES

NO	PROPERTY	EXPECTED STANDARDS
1	Deviation in length	(+/-) 0.6%
2	Straightness of sides	(+/-) 0.5%
3	Rectangularity	(+/-) 0.6%
4	Surface flatness	(+/-) 0.5%
5	Water absorption	< 0.50%
6	Mohs. hardness	> 6
7	Flexural strength	> 27 N / mm2
8	Abrasion resistance	< 204 mm2
9	Skid resistance (friction coefficient)	> 0.4
10	Glossiness	Min. 85% reflection

The tiles shall conform to the relevant standards in all respects. Samples of tiles shall be got approved from the Project Manager before bulk procurement for incorporation in the work.

9.7.2.0 PREPARATION OF SURFACE FOR FLOORING:

Following procedure shall be followed:
Sub grade concrete or RCC slab or side brick / block wall / or plastered surfaces on which tiles are to be laid shall be cleaned, wetted and mopped.

Mortar and bedding: Cement mortar for bedding shall be prepared of mix 1:4 or as specified in the schedule of items, to a consistent paste and shall conform to the specification for materials, preparations etc. as specified under cement mortar. The amount of water added while preparing mortar shall be the minimum necessary to give sufficient plasticity for laying. Care shall be taken in preparation of the mortar to ensure that there are no hard lumps that would interfere with even bedding of the tiles. Before spreading the mortar bed the base shall be cleaned off all dirt, scum or laitance and loose materials and well wetted without forming any pools of water on the surface. The mortar of specified proportion and thickness shall then be evenly and smoothly spread over the base by use of screed battens to proper level or slope.

Once the mix is prepared, no further water be added and the same shall be used within one hour of adding water. Apply on an average 20 mm thick bedding of mortar over an area of 1 Sqm. at a time over surface of the area for laying tiles, in proper level and allowed to harden sufficiently to offer a fairly good cushion for the tiles to set.

9.7.3.0 LAYING OF TILES FOR FLOORING:

The tiling work shall be done as per the pattern shown in the drawing or as directed by the Project Manager. As a general practice laying of tiles shall be commenced from the centre of the area and advanced towards the walls. Cut tiles, if any, shall be laid along wall with necessary border /pattern as shown / directed by the Project Manager. Tiling work shall be completed by pressing tiles firmly into place along the wall / floor. A white cement slurry to the back of the tile to be applied to ensure proper and full bedding. The tiles shall be laid on the bedding mortar when it is still plastic but has become sufficiently stiff to offer a fairly firm cushion for the tiles. Tiles, which are fixed on the flooring adjoining the wall, shall be so arranged that the surface on the round edge tiles shall correspond to the skirting or dado. Press gently the tile with wooden mallet for even adherence at the back of the tile. Do not use an iron hammer or some heavy material to press the tile.

The edges of the tiles shall be smeared with neat white cement slurry and fixed in this grout one after the other, each tile being well pressed and gently tapped with a wooden mallet till it is properly bedded and in level with the adjoining tiles. There shall be no hollows in bed or joints. The joints shall be kept as close as possible and in straight line. Unless otherwise specified, joint-less tiling shall be done butting the tiles with each other. If joint is specified, the same shall be as specified by the Project Manager. The joint shall be grouted with white / matching colour cement slurry. After fixing the tiles, finally in an even plane or slope, the flooring shall be covered & protected with foam/Bubble sheet of 6to8MM thick and allowed undisturbed for 14 days.

9.7.4.0 FIXING TILES FOR DADO & SKIRTING / FACIA:

The fixing of tiles on wall surfaces shall be done only after completing fixing of the tiles on the floor. Following procedure shall be followed:
The back of tiles shall be cleaned off and covered with layer of cement paste or approved adhesive like BAL-ENDURA or equivalent with proper toweling as per manufacturer's recommendations.

The edges of the tiles shall be smeared with cement paste or adhesive and fixed on the wall one after the other, each tile being well pressed and gently tapped with a wooden mallet till it is properly fixed in level with the adjoining tiles. There shall be no hollows on the back or in joints. Unless otherwise specified, joint-less tiling shall be done butting the tiles with each other. If joint is specified by the Project Manager, the joint shall be grouted with approved white / matching colour cement slurry cement or adhesive. The joints shall be kept in straight line or as per the approved pattern.

While fixing tiles in dado / skirting work, care shall be taken to break the joints vertically. The top line shall be touched up neatly with the rest of the plaster above. If doors, windows, sanitary fittings or other openings are located within the dado area, the corners, sills, jambs etc. shall be provided with true right angles without any specials. The contractor will not be entitled to any extra claims on this account for cutting of tiles if required.

The fixing shall be done from bottom of wall to upward without any hollows in the bed of joints. Each tile shall be as close as possible to one adjoining. All tiles faces shall be in one vertical plane.

9.7.5.0 GROUTING OF JOINTS IN FLOOR / SKIRTING / DADO:

The joints, if specified, shall be cleaned off and all dust and loose particles removed. Joints shall then be filled with approved adhesive like BAL-ENDURA or equivalent grouts. After finishing the grouting process, after 15 minute, wipe off excess grout with a damp sponge and polish the tiles with a soft & dry cloth for a clean surface. The Finished work shall not sound hollow when tapped with a wooden mallet.

9.7.6.0 CLEANING:

As directed by the Project Manager, the tiles shall be cleaned by mild acid (However, Hydrofluoric acid and its derivatives should not be used). After the tiles have been laid in a room or the days fixing work is completed, the surplus cement grout / adhesive that may have come out of the joints shall be cleaned off before it sets. The dado / skirting shall be thoroughly cleaned. In the case of flooring, once the floor has set, the floor shall be carefully washed clean and dried. When drying, the floor shall be covered

with oil free dry sawdust. It shall be removed only after completion of the construction work and just before the floor is used.

9.7.7.0 MODE OF MEASUREMENT AND RATE:

Dado / flooring / skirting shall be measured in Sqm correct to two places of decimal. Length and breadth shall be measured correct to 1 cm. between the exposed surfaces of skirting or dado. No deductions shall be made nor extra paid for any opening of area upto 0.1 Sqm. The rate shall include all the cost of labour and materials involved.

9.7.8.0 CLEANING AGENTS FOR VITRIFIED TILES:

Vitrified tiles are resistant to all chemicals (except hydrofluoric acid and its derivatives), hence commercially available detergents and cleaning agents can also be used for regular maintenance. Any spills and stains must be removed immediately. If left dry they may leave stains, which may be difficult to remove completely.

9.7.9.0 **MAKE AND MODEL OF VITRIFIED TILES SELECTED**

SL NO	DESCRIPTION OF THE TILE	LOCATION
1	600X600MM – PIETRA PERLA MATT FINISH (KAJARIA)	CORRIDORS
2	400X1200MM – CARDIFF GREY MATT FINISH (KAJARIA)	ROOM
3	400X1200MM – DENVER GREY MATT FINISH (KAJARIA)	TOILET DADOING
4	600X600MM - PIETRA PERLA STONE FINISH (KAJARIA)	THIRD & FOURTH FLOOR TERRACES
5	20 to 25MM THICK – ROUGH/POLISH TANDUR STONE	GROUND FLOOR CORRIDOR

9.7.10.0 CLEANING AGENTS FOR VITRIFIED TILES

STAINS	CLEANING AGENT
Robin Blue	Household detergent / Warm water
Marker ink	Turpentine / Acetone / Trichloroethylene
Pen ink	Acetone / Isopropyl alcohol
Methylene blue	Isopropyl alcohol / Acetone
Sauce	Ammonia solution
Cement	Turpentine / Acetone / Trichloroethylene / Conc. HCL
Tea	Hydrochloric acid / Bleaching powder
Coffee	Sodium hydroxide / Potassium hydroxide
Beer	Sodium hydroxide / Potassium hydroxide
Diesel	Acetone / Petrol
Lab indicator	Acetone / Isopropyl alcohol
Cement and grouting	Hydrochloric acid
Pencil mark	Benzene or Toluene or Xylene
Plaster of Paris (POP)	Ammonium sulphate solution
Iodine (Tincture iodine)	Sodium hydroxide / Potassium hydroxide
Hair dye	Per chloric acid
Paan	Lemon juice or citric acid
Marker pen	Acetone

VI. CEMENT PLASTERING FOR INTERNAL WALLS & CEILINGS WITH SMOOTH RENDERING:
The cement plaster shall be 12 mm, 15 mm thick or as specified in BOQ the item no II (2),IV (2)

General Note applies to all plastering works: The rate for all plastering item is to be inclusive of - Making of grooves, Bands,drip moulds,at Wall and Ceilings junctions and at Above Skirtings, and making good with Cement mortor all the chasings / chippings, Bore packings done for other services such as Electrical, PHE, Fire, HVAC, etc.with fixing of **Arpitha/suchitra industries** Plastering mesh of 125mm width in single/double layer as required at junction of column/beam and other concrete surface with masonry, to be fixed prior to plastering with necessary nail/screw etc, complete.Waterproofing compound to be used as required to Borepackings to make it water tight from any leakages.with all necessary staging, scaffolding internal and external.

12.1.1 Scaffolding
For all exposed block work, concrete surface scaffolding independent of the work having two sets of vertical / horizontal supports shall be provided. The supports shall be sound and strong, tied together with horizontal pieces over which scaffolding planks shall be fixed.

For all other work in buildings, single scaffolding shall be permitted. In such cases the inner end of the horizontal scaffolding pole shall rest in a hole provided only in the header course for the purpose.

Only one header for each pole shall be left out. Such holes for scaffolding shall, however, not be allowed in pillars/columns less than one metre in width or immediately near the skew backs of arches. The holes left in masonry works for scaffolding purposes shall be filled and made good before plastering.

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

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

12.1.3 Mortar
The mortar of the specified mix using the type of sand described in the item shall be used. It shall be as specified in Subhead 3.0. For external work and under coat work, the fine aggregate shall conform to grading IV. For finishing coat work the fine aggregate conforming to grading zone V shall be used.

12.1.4 Application of Plaster
12.1.4.1 Ceiling plaster shall be completed before commencement of wall plaster.

12.1.4.2 Plastering shall be started from the top and worked down towards the floor. All putlog holes shall be properly filled in advance of the plastering as the scaffolding is being taken down. To ensure even thickness and a true surface, plaster about 15 × 15 cm shall be first applied, horizontally and vertically, at not more than 2 metres intervals over the entire surface to serve as gauges. The surfaces of these gauged areas shall be truly in the plane of the finished plaster surface. The mortar shall then be laid on the wall, between the gauges with trowel. The mortar shall be applied in a uniform surface slightly more than the specified thickness. This shall be brought to a true surface, by working a wooden straight edge reaching across the gauges, with small upward and side ways movements at a time. Finally the surface shall be finished off true with trowel or wooden float according as a smooth or a sandy granular texture is required. Excessive trowelling or over working the float shall be avoided.

12.1.4.3 All corners, arrises, angles and junctions shall be truly vertical or horizontal as the case may be and shall be carefully finished. Rounding or chamfering corners, arrises, provision of grooves at junctions etc. where

required shall be done without any extra payment. Such rounding, chamfering or grooving shall be carried out with proper templates or battens to the sizes required.

12.1.4.4 When suspending work at the end of the day, the plaster shall be left, cut clean to line both horizontally and vertically. When recommencing the plastering, the edge of the old work shall be scrapped cleaned and wetted with cement slurry before plaster is applied to the adjacent areas, to enable the two to properly join together. Plastering work shall be closed at the end of the day on the body of wall and not nearer than 15 cm to any corners or arrises. It shall not be closed on the body of the features such as plasters, bands and cornices, nor at the corners of arrises. Horizontal joints in plaster work shall not also occur on parapet tops and copings as these invariably lead to leakages. The plastering and finishing shall be completed within half an hour of adding water to the dry mortar.

No portion of the surface shall be left out initially to be patched up later on. The plastering and finishing shall be completed within half an hour of adding water to the dry mortar.

Lime shall be prepared from best available hydraulic lime slaked with fresh water and sifted. The lime shall be ground fine in a mortar mill and kept moist until used. A sample of lime to be used shall be produced by the contractor for the approval of Project Manager. Samples of lime may be subjected to tests as per relevant I.S. before final approval. All lime to be used on the work shall conform to the approved sample.

12.1.5 Thickness

Where the average thickness required as per description of the item is 12mm, 15mm, 20mm, the average thickness of the plaster shall not be less than specified above whether the wall treated is of block or stone or concrete surface.

12.1.6 Curing

Curing shall be started as soon as the plaster has hardened sufficiently not to be damaged when watered.

The plaster shall be kept wet for a period of at least 7 days. During this period, it shall be suitably protected from all damages at the contractor's expense by such means as the Architect / Project Manager may approve. The dates on which the plastering is done shall be legibly marked on the various sections plastered so that curing for the specified period thereafter can be watched.

12.1.7 Finish

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

12.1.8 Precaution

Any cracks which appear in the surface and all portions which sound hollow when tapped, or are found to be soft or otherwise defective, shall be cut out in rectangular shape and redone as directed by the Architect / Project Manager.

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

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

12.1.9 Measurements

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

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

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

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

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

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

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

(ii) When two faces of walls are plastered with different types of plaster or if one face is plastered and other is pointed or one face is plastered and other is unplastered, deduction shall be made from the plaster or pointing on the side of the frame for the doors, windows etc. on which width of reveals is less than that on the other side but no deduction shall be made on the other side.

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

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

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

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

12.2.0 Rate

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

12.2.1 18MM THICK CEMENT PLASTER FOR EXTERNAL SURFACE (TWO COAT WORK)

12.2.1 The specification for scaffolding and preparation of surface shall be as described in 12.1

12.2.2 Mortar

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

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

12.2.3 Application

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

12.2.3.2 12mm Under Coat : This shall be applied as specified in 12.1.4 except that when the plaster has been brought to a true surface a wooden straight edge and the surface shall be left rough and furrowed 2 mm deep

with a scratching tool diagonally both ways, to form key for the finishing coat. The surface shall be kept wet till the finishing coat is applied.

12.2.3.3 6 mm Finishing Coat : The finishing coat shall be applied after the under coat has sufficiently set but not dried and in any case within 48 hours and finished in the manner specified in 12.1.4.

12.2.4 Specifications for Curing, Finishing, Precautions, Measurements and Rate shall be as described under 12.1.

12.3 CEMENT WATER PROOFING COMPOUND
It shall be used for cement mortar for plastering or concrete work.

12.3.1 Water Proofing Compound
Integral cement water proofing compound conforming to IS 2645 and of approved brand and manufacture, enlisted by the Architect / Project Manager from time to time shall be used.

12.3.2 The contractor shall bring the materials to the site in their original packing. The containers will be opened and the material mixed with dry cement in the proportion by weight, recommended by the manufacturers or as specifically described in the description of the item. Care shall be taken in mixing, to see that the water proofing material gets well and integrally mixed with the cement and does not run out separately when water is added.

12.3.3 It shall be measured by weight.

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

13.1.0 PAINTING
13.1.1 Materials
Paints, oils, varnishes etc. of approved brand and manufacture shall be used. Only ready mixed Paint (Exterior grade) as received from the manufacturer without any admixture shall be used.

If for any reason, thinning is necessary in case of ready mixed Paint, the brand of thinner recommended by the manufacturer or as instructed by the Architect / Project Manager shall be used.

Approved Paints, oil or varnishes shall be brought to the site of work by the contractor in their original containers in sealed condition. The material shall be brought in at a time in adequate quantities to suffice for the whole work or at least a fortnight's work. The materials shall be kept in the joint custody of the contractor and the Architect / Project Manager. The empties shall not be removed from the site of work, till the relevant item of work has been completed and permission obtained from the Architect / Project Manager.

13.1.2 Commencing Work
Painting shall not be started until the Architect / Project Manager has inspected the items of work to be painted, satisfied himself about their proper quality and given his approval to commence the painting work.

Painting of external surface should not be done in adverse weather condition like hail storm and dust storm.

Painting, except the priming coat, shall generally be taken in hand after practically finishing all other building work.

The rooms should be thoroughly swept out and the entire building cleaned up, at least one day in advance of the Paint work being started.

13.1.3 Preparation of Surface
The surface shall be thoroughly cleaned and dusted off. All rust, dirt, scales, smoke splashes, mortar droppings and grease shall be thoroughly removed before painting is started. The prepared surface shall have received the approval of the Architect / Project Manager after inspection, before painting is commenced.

13.1.4 Application

13.1.4.1 Before pouring into smaller containers for use, the Paint shall be stirred thoroughly in its containers, when applying also, the Paint shall be continuously stirred in the smaller containers so that its consistency is kept uniform.

13.1.4.2 The painting shall be laid on evenly and smoothly by means of crossing and laying off, the latter in the direction of the grains of wood. The crossing and laying off consists of covering the area over with Paint, brushing the surface hard for the first time over and then brushing alternately in opposite direction, two or three times and then finally brushing lightly in a direction at right angles to the same. In this process, no brush marks shall be left after the laying off is finished. The full process of crossing and laying off will constitute one coat.

13.1.4.3 Where so stipulated, the painting shall be done by spraying. Spray machine used may be

(a) high pressure (small air aperture) type, or
(b) a low pressure (large air gap) type, depending on the nature and location of work to be carried out. Skilled and experienced workmen shall be employed for this class of work. Paints used shall be brought to the requisite consistency by adding a suitable thinner.

13.1.4.4 Spraying should be done only when dry condition prevails. Each coat shall be allowed to dry out thoroughly and rubbed smooth before the next coat is applied. This should be facilitated by thorough ventilation. Each coat except the last coat, shall be lightly rubbed down with sand paper or fine pumice stone and cleaned off dust before the next coat is laid.

13.1.4.5 No left over Paint shall be put back into the stock tins. When not in use, the containers shall be kept properly closed.

13.1.4.6 No hair marks from the brush or clogging of Paint puddles in the corners of panels, angles of mouldings etc. shall be left on the work.

13.1.4.7 In painting doors and windows, the putty round the glass panes must also be painted but care must be taken to see that no Paint stains etc. are left on the glass. Tops of shutters and surfaces in similar hidden locations shall not be left out in painting. However, bottom edge of the shutters where the painting is not practically possible, need not be done nor any deduction on this account will be done but two coats of primer of approved make shall be done on the bottom edge before fixing the shutters.

13.1.4.8 On painting steel work, special care shall be taken while painting over bolts, nuts, rivets overlaps etc.

13.1.4.9 The additional specifications for primer and other coats of Paints shall be as according to the detailed specifications under the respective headings.

13.1.5 Brushes and Containers

After work, the brushes shall be completely cleaned of Paint and linseed oil by rinsing with turpentine. A brush in which Paint has dried up is ruined and shall on no account be used for painting work. The containers when not in use, shall be kept closed and free from air so that Paint does not thicken and also shall be kept safe from dust. When the Paint has been used, the containers shall be washed with turpentine and wiped dry with soft clean cloth, so that they are clean, and can be used again.

13.1.6 Measurements

13.1.6.1 The length and breadth shall be measured correct to a cm. The area shall be calculated in sqm (correct to two places of decimal), except otherwise stated.

13.1.6.2 Small articles not exceeding 10 sq decimetre (0.1sqm) of painted surfaces where not in conjunction with similar painted work shall be enumerated.

13.1.6.3 Painting upto 10 cm in width or in girth and not in conjunction with similar painted work shall be given in running metres and shall include cutting to line where so required.

Note : Components of trusses, compound girders, stanchions, lattices and similar work shall, however, be given in sq. metres irrespective of the size or girth of members. Priming coat of painting shall be included in the work of fabrication.

13.1.6.4 In measuring painting, varnishing, oiling etc. of joinery and steel work etc. The coefficients as indicated in following tables shall be used to obtain the area payable. The coefficients shall be applied to the areas measured flat and not girthed.

TABLE 13.1
Equivalent Plain Areas of Uneven Surface

S. No.	**Description of work**	**How measured**	**Multiplying coefficients**
1	**2**	**3**	**4**
I. Wood work doors, windows Etc.			
1.	Panelled or framed and braced doors, windows etc.	Measured flat (not girthed including)	1.30 (for each side)
2.	Ledged and battened or ledged, battened and braced doors, windows etc.	Chowkhat or frame, Edges, chocks, cleats, etc. shall be deemed to be included in the item.	- do -
3.	Flush doors etc.	-do-	1.20 (for each side)
4.	Part panelled and part glazed or gauzed doors, window etc. (Excluding painting of wire gauze portion)	-do-	1.00 (for each side)
5.	Fully glazed or gauzed doors, windows etc. (Excluding painting of wire gauze portion)	-do-	0.80 (for each side)
6.	Fully venetioned or louvered doors, windows etc.		1.80 (for each side)
7.	Trellis (or Jaffri) work one way or two way	Measured flat overall, no deduction shall be made for open spaces, supporting members shall not be mea sured separately	2 (for painting all over)
8.	Carved or enriched work	Measured flat	2 (for each side)
9.	Weather boarding	Measured flat (not girthed supporting frame work shall not be measured separately	1.20 (for each side)
10.	Wood shingle roofing	Measured flat (not girthed)	1.10 (for each side)
11.	Boarding with cover fillets	Measured flat (not girthed) and match boarding	1.05 (for each side)
12.	Tile and slate battening	Measured flat overall no deductions shall be made for open spaces	0.80 (for painting all over)
II. Steel work doors, windows Etc.			
13.	Plain sheeted steel doors or windows including frame edges etc.	Measured flat (not girthed)	1.10 (for each side)
14.	Fully glazed or gauzed steel doors and windows (excluding painting of wire gauze portion)	-do-	0.50 (for each side)

15. Partly panelled and partly glazed or gauzed doors and windows (excluding painting of wire gauze portion)	-do-	0.80 (for each side)
16. Corrugated sheeted steel doors or windows	-do-	1.25 (for each side)
1 2 3	**4**	
17. Collapsible gates	Measured flat	1.50 (for painting all over)
18. Rolling shutters of interlocked laths	Measured flat (size of opening) all over; jamb guides, bottom rails and locking arrangement etc. shall be included in the item (top cover shall be measured separately)	1.10 (for each side)
III. General		
19. Expanded metal, hard drawn steel wire fabric of approved quality, grill works and gratings in guard bars, balustrades, railing partitions and MS Bars in windows frames.	Measured flat overall; no deduction shall be made for open spaces; supporting members shall not be measured separately	1 (for Paint all over)
20. Open palisade fencing and gates including standards, braces, rails stays etc. in timber or steel	-do- (see note No. 12)	1 (for Paint all over)
21. Corrugated iron sheeting in roofs, side cladding etc.	-do- Measured flat (not girthed)	1.14 (for each side)
22. AC corrugated sheeting in roofs, side cladding etc.	-do-	1.20 (for each side)
23. AC semi corrugated sheeting in roofs, side cladding etc. or Nainital pattern using plain sheets	-do-	1.10 (for each side)
24. Wire gauze shutters including painting of wire gauze	-do-	1.00 (for each side)

Explanatory Notes for Table 13.1

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

13.1.7 Precautions

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

13.1.8 Rate

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

13.2 EXTERIOR PAINTING ON WALL

13.2.1 Material (Renova / Spectrum):

The paint shall be (Texured exterior paint/Acrylic smooth exterior paint/premium acrylic smooth exterior paint) of approved brand and manufacture.

This paint shall be brought to the site of work by the contractor in its original containers in sealed condition. The material shall be brought in at a time in adequate quantities to suffice for the whole work or at least a fornight's work. The materials shall be kept in the joint custody of the contractor and the Architect / Project Manager. The empty containers shall not be removed from the site of work till the relevant item of work has been completed and permission obtained from the Architect / Project Manager.

13.2.2 Preparation of Surface
For new work, the surface shall be thoroughly cleaned off all mortar dropping, dirt dust, algae, fungus or moth, grease and other foreign matter of brushing and washing, pitting in plaster shall make good, surface imperfections such as cracks, holes etc. should be repaired using white cement. The prepared surface shall have received the approval of the Engineer in charge after inspection before painting is commenced.

13.2.3 Application
Base coat of water proofing cement paint

13.2.3.1 All specifications in respect of base coat of water proofing cement paint shall be as described under 13.2.

13.2.3.2 Before pouring into smaller containers for use, the paint shall be stirred thoroughly in its container, when applying also the paint shall be continuously stirred in the smaller containers so that its consistency is kept uniform. Dilution ratio of paint with potable water can be altered taking into consideration the nature of surface climate and as per recommended dilution given by manufacturer. In all cases, the manufacturer's instructions & directions of the Architect / Project Manager shall be followed meticulously.

The lids of paint drums shall be kept tightly closed when not in use as by exposure to atmosphere the paint may thicken and also be kept safe from dust.

13.2.3.3 Paint shall be applied with a brush on the cleaned and smooth surface. Horizontal strokes shall be given, First and vertical strokes shall be applied immediately afterwards. This entire operation will constitute one coat. The surface shall be finished as uniformly as possible leaving no brush marks.

13.2.4 The specifications in respect of scaffolding, protective measures, measurements and rate shall be as described under 13.14.

13.3 PAINTING PRIMING COAT ON WOOD, IRON OR PLASTERED SURFACES
13.3.1 Primer

13.3.1.1 The primer for wood work, iron work or plastered surface shall be as specified in the description of item.

13.3.1.2 Primer for plaster/wood work/Iron & Steel/Aluminium surfaces shall be as specified below:

TABLE 13.2

S.No.	Surfaces	Primer to be used
1.	Wood work (hard and soft wood)	Pink conforming to IS 3536
2.	Resinour wood and plywood	Aluminium primer conforming to IS 3585
3.	(A) Aluminium and light alloys	Zinc chromate primer conforming to IS 104
	(B) Iron, Steel and Galvanized steel	Red Oxide Zinc chromate Primer conforming IS 2074
4.	Cement/Conc/RCC/brick work, Plastered surfaces, non-asbestos surfaces to receive Oil bound distemper or Paint finish.	Cement primer conforming to IS 109

13.3.1.3 The primer shall be ready mixed primer of approved brand and manufacture.

13.3.1.4 Where primer for wood work is specified to be mixed at site, it shall be prepared from a mixture of red lead, white lead and double boiled linseed oil in the ratio of 0.7 kg : 0.7 kg : 1 litre.

13.3.1.5 Where primer for steel work is specified to be mixed at site, it shall be prepared from a mixture of red lead, raw linseed oil and turpentine in the ratio of 2.8 kg : 1 litre : 1 litre.

13.3.1.6 The specifications for the base vehicle and thinner for mixed on site primer shall be as follows:

(a) White Lead : The White lead shall be pure and free from adulterants like barium sulphate and whiting. It shall conform to IS 103.
(b) Red Lead : This shall be in powder form and shall be pure and free from adulterants like brick dust etc. It shall conform to IS 102.
(c) Raw Linseed Oil : Raw linseed oil shall be lightly viscous but clear and of yellowish colour with light brown tinge. Its specific gravity at a temperature of 30 degree C shall be between 0.923 and 0.928.

Note : The oil shall be mellow and sweet to the taste with very little smell. The oil shall be of sufficiently matured quality. Oil turbid or thick, with acid and bitter taste and rancid odour and which remains sticky for a considerable time shall be rejected. The oil shall conform in all respects to IS 75. The oil shall be of approved brand and manufacture.

(d) Double Boiled Linseed Oil : This shall be more viscous than the raw oil, have a deeper colour and specific gravity between 0.931 and 0.945 at a temperature of 30 degree C. It shall dry with a glossy surface. It shall conform in all respects to IS 77. The oil shall be of approved brand and manufacture.

Turpentine : Mineral turpentine i.e. petroleum distillate which has the same rate of evaporation as vegetable turpentine (distillate product of oleeresin of conifers) shall be used. It shall have no grease or other residue when allowed to evaporate. It shall conform to IS 533.

13.3.1.7 All the above materials shall be of approved manufacture and brought to site in their original packing in sealed condition.

13.3.2 Preparation of Surface

13.3.2.1 Wooden Surface : The wood work to be painted shall be dry and free from moisture.
The surface shall be thoroughly cleaned. All unevenness shall be rubbed down smooth with sand paper and shall be well dusted. Knots, if any shall be covered with preparation of red lead made by grinding red lead in water and mixing with strong glue sized and used hot. Appropriate filler material conforming to IS 345 with same shade as Paint shall be used where specified. The surface treated for knotting shall be dry before

Paint is applied. After obtaining approval of Architect / Project Manager for wood work, the priming coat shall be applied before the wood work is fixed in position. After the priming coat is applied, the holes and indentation on the surface shall be stopped with glazier's putty or wood putty.

Stopping shall not be done before the priming coat is applied as the wood will absorb the oil in stopping and the latter is therefore liable to crack.

13.3.2.2 Iron & Steel Surface : All rust and scales shall be removed by scrapping or by brushing with steel wire brushes. Hard skin of oxide formed on the surface of wrought iron during rolling which becomes loose by rusting, shall be removed.

All dust and dirt shall be thoroughly wiped away from the surface.

If the surface is wet, it shall be dried before priming coat is undertaken.

13.4 WALL PAINTING WITH PLASTIC EMULSION PAINT (FOR INTERNAL MASONRY WALLS GYPSUM & RCC CEILINGS) (APPLIABLE TO BOQ ITEM NO II (4),V(4)
13.4.0 The plastic emulsion Paint is not suitable for application on external, wood and iron surface and surfaces which are liable to heavy condensation. These Paints are to be used on internal surfaces except wooden and steel.

13.4.1 Plastic Emulsion Paint as per IS 5411 of approved brand and manufacture and of the required shade shall be used.

13.4.2 Painting on New Surface

13.4.2.1 The wall surface shall be prepared as specified in 13.1.0.

13.4.2.2 Application : The number of coats shall be as stipulated in the item. The Paint will be applied in the usual manner with brush, spray or roller. The Paint dries by evaporation of the water content and as soon as the water has evaporated the film gets hard and the next coat can be applied. The time of drying varies from one hour on absorbent surfaces to 2 to 3 hours on non-absorbent surfaces.

The thinning of emulsion is to be done with water and not with turpentine. Thinning with water will be particularly required for the under coat which is applied on the absorbent surface. The quantity of water to be added shall be as per manufacturer's instructions.

The surface on finishing shall present a flat velvety smooth finish. If necessary more coats will be applied till the surface presents a uniform appearance.

13.4.2.3 Precautions

(a) Old brushes if they are to be used with emulsion Paints, should be completely dried of turpentine or oil Paints by washing in warm soap water. Brushes should be quickly washed in water immediately after use and kept immersed in water during break periods to prevent the Paint from hardening on the brush.
(b) In the preparation of wall for plastic emulsion painting, no oil base putties shall be used in filling cracks, holes etc.
(c) Splashes on floors etc. shall be cleaned out without delay as they will be difficult to remove after hardening.
(d) Washing of surfaces treated with emulsion Paints shall not be done within 3 to 4 weeks of application.

13.4.2.4 Other details shall be as specified in 13.1.0 as far as they are applicable.

13.5 PAINTING WITH SYNTHETIC ENAMEL PAINT ON WOOD WORK, M.S. SECTIONS, ETC.

13.5.1 Synthetic Enamel Paint (conforming to IS 2933) of approved brand and manufacture and of the required colour shall be used for the top coat and an undercoat of ordinary Paint of shade to match the top coat as recommended by the same manufacturer as far the top coat shall be used.

13.5.2 Painting on New Surface

13.5.2.1 Preparation of surface shall be as specified in 13.1.0 as the case may be.

13.5.2.2 Application : The number of coats including the undercoat shall be as stipulated in the item.

(a) Under Coat : One coat of the specified ordinary Paint of shade suited to the shade of the top coat, shall be applied and allowed to dry overnight. It shall be rubbed next day with the finest grade of wet abrasive paper to ensure a smooth and even surface, free from brush marks and all loose particles dusted off.
(b) Top Coat : Top coats of synthetic enamel Paint of desired shade shall be applied after the undercoat is thoroughly dry. Additional finishing coats shall be applied if found necessary to ensure properly uniform glossy surface.

13.5.2.3 Other details shall be as specified in 13.2.0 as far as they are applicable.

13.5.2.4 Painting : The number of coats as stipulated in the item shall be applied with synthetic enamel Paint. Each coat shall be allowed to dry and rubbed down smooth with very fine wet abrasive paper, to get an even glossy surface. If however, the surface is not satisfactory additional coats as required shall be applied to get correct finish.

13.5.2.5 Other details shall be specified in 13.2.0 as far as they are applicable

VII:Water Proofing works
(Applicable for all Items of work as per BOQ Ref Item no. IV(1),(7)

Scope

This specification covers the waterproofing system for Raft slab and the Retaining wall (both internal and external protection) of the UG Sump structure.

General

1. **Quality assurance**: All products in the system shall meet the key performance properties listed in Section D against each and shall be sourced from manufacturers with a certified QA system such as, ISO 9001 or an established and proven QA system that has ensured consistent products.
2. **Approved sources:** All products in the specified system shall be sourced from a single manufacturer from amongst the list of approved products and sources for each in Section E.
3. **Installation:** All the products/systems specified in this document shall be installed by a Specialist Applicator approved by the manufacturer strictly in accordance to the written application guide by the manufacturer.
4. **Multiple sources and compatibility:** Should the Specialist Applicator or the Contractor want to use products from different sources, they shall submit proof of compatibility between those products from different sources.
5. **Alternate equivalents:** Should the Specialist Applicator or Contractor prefer to use alternative product(s) equivalent to the approved list in Section E, it can only be after obtaining a written approval by the specifier; such approvals for alternative systems can only issued by the specifier after ascertaining conformity to the specified key performance properties.
6. **Substrate preparation:** Before starting to install the specified waterproofing system, the substrate shall be jointly inspected by the Contractor and the Specialist Applicator for soundness; any defects shall first be repaired utilising products and systems compatible with the specified waterproofing system.

The waterproofing system

The specified waterproofing system for the underground and overhead sump comprises of the following different systems, each generic product specified shall meet the key performance properties in section D.

1. Admixture System for Casting Low permeability concrete slab

PCE based hyper Plasticiser shall be used to produce SCC of designed strength, which is free from honeycombs and cavities

2. Waterproofing system for external surface of tank

i. Fast Drying High performance epoxy primer and sand broadcasting over the primer

ii. Spray applied elastomeric polyurethane waterproofing membrane.

iii. Within three days of the installation of the waterproofing system, the waterproofing membrane shall be covered protection layer

3. Penetrating pipe Treatment using non-shrink cementitious grout

4. Coating for Internal surface of UG Sump Non-toxic solvent free high build epoxy resin protective coating for concrete

Approved products

The following products from their respective manufacturer for each type of product meet the specified key properties in Section D and are approved for use in this job.

	Type of product	**Approved products**	**Manufacturer**
1.	High-performance super plasticiser based on PCE (Polycarboxylic ether)	Master Glenium SKY 8600 series	BASF

2	Spray applied elastomeric polyurethane waterproofing membrane	MasterSeal M 800	BASF
3	Non- Shrink Cementitious Grout for pipe penetration area	MasterFlow 718	BASF
4	Non-toxic, Solvent free epoxy based Protective Coating	MasterSeal 180	BASF

E. Application:

Please refer to the Method Statement for preparation, mixing, application and finishing details, as per the manufacturer. This will be submitted based on the site condition after receiving the order but before the commencement of the application job

F. Testing

The Contractor shall ensure, by testing if necessary, that the products meet the specified key properties, before their installation by the applicator.

If any seepage of water noticed in the structure, the applicator shall make good those areas by an approved method, and re-inspect to the satisfaction of the Architect /Consultant

Specification for waterproofing of Covered RCC

Scope

This specification covers the waterproofing system for covered RCC slabs including driveway and walkway.

General

5. ***Quality assurance****: All products in the system shall meet the key performance properties listed in Section D against each and shall be sourced from manufacturers with a certified QA system such as, ISO 9001 or an established and proven QA system that has ensured consistent products.*
6. ***Approved sources:*** *All products in the specified system shall be sourced from a single manufacturer from amongst the list of approved products and sources for each in Section E.*
7. ***Installation:*** *All the products/systems specified in this document shall be installed by a Specialist Applicator approved by the manufacturer strictly in accordance to the written application guide by the manufacturer.*
8. ***Multiple sources and compatibility:*** *Should the Specialist Applicator or the Contractor want to use products from different sources, they shall submit proof of compatibility between those products from different sources.*
9. ***Alternate equivalents:*** *Should the Specialist Applicator or Contractor prefer to use alternative product(s) equivalent to the approved list in Section E, it can only be after obtaining a written approval by the specifier; such approvals for alternative systems can only issued by the specifier after ascertaining conformity to the specified key performance properties.*
10. ***Substrate preparation:*** *Before starting to install the specified waterproofing system, the substrate shall be jointly inspected by the Contractor and the Specialist Applicator for soundness; any defects shall first be repaired utilising products and systems compatible with the specified waterproofing system.*

The waterproofing system for flat covered podium area

The specified waterproofing system for the covered RCC comprises of the following different systems, each generic product specified shall meet the key performance properties in section D.

a) Low Permeability of Concrete Slabs

PCE based hyper plasticiser shall be used to produce SCC of designed strength which is absolutely free from honey combs and cavities

b) Expansion Joint using single component polyurethane based elastomeric joint sealant

c) Drain water pipe Treatment using non-shrink cementitious grout

d) Waterproofing system for covered podium for pedestrian walk ways

i. Fast Drying High performance epoxy primer and sand broadcasting over the primer

ii. Spray applied elastomeric polyurethane waterproofing membrane.

iii. Within three days of the installation of the waterproofing system, the waterproofing membrane shall be covered with tiles, pre-cast concrete panels or other such covering resistant to pedestrian traffic

e) Exposed carpark marking for driveways and parking slot

i. Fast Drying High performance epoxy primer and sand broadcasting over the primer

ii. Two component top coat high solids, pigmented, UV stable, for broadcasted outdoor car parking systems.

f) Exposed Waterproofing system for parapet walls

i. Solvent free epoxy primer, which should also be free from fillers

ii. Spray applied elastomeric polyurethane waterproofing membrane

iii. Two component high solids pigmented UV stable & weather resistant polyurethane top sealer shall be roller applied

G. Approved products

The following products from their respective manufacturer for each type of product meet the specified key properties in Section D and are approved for use in this job.

	Type of product	**Approved products**	**Manufacturer**
	High performance Super plasticiser based PCE	Master Glenium SKY 8600 series	BASF
1	Solvent free epoxy primer	MasterSeal P 2525	BASF
2	Spray applied elastomeric polyurethane waterproofing membrane	MasterSeal M 800	BASF
3	Roller applied UV and weathering resistant top sealer coat.	MasterSeal TC 269	BASF
4	Solvent free 2 component Aromatic Polyurethane	MasterSeal TC 242	BASF
5	Single component polyurethane based elastomeric joint sealant	MasterSeal NP 472	BASF

H. Application:

Please refer to the Method Statement for preparation, mixing, application and finishing details, as per the manufacturer. This will be submitted based on the site condition after receiving the order but before the commencement of the application job

I. Testing

The Contractor shall ensure, by testing if necessary, that the products meet the specified key properties, before their installation by the applicator.

If any seepage of water noticed in the structure, the applicator shall make good those areas by an approved method, and re-inspect to the satisfaction of the Architect /Consultant

Specification for waterproofing of Toilet Sunken Area

A. SCOPE

This specification covers the waterproofing system for the Toilet Sunken Area.

B. GENERAL

1. ***Quality assurance***: *All products in the system shall meet the key performance properties listed against each segment and shall be sourced from manufacturers with a certified QA system such as, ISO 9001 or an established and proven QA system that has ensured consistent products.*
2. ***Approved sources:*** *All products in the specified system shall be sourced from a single manufacturer from amongst the list of approved products and sources for each in Section E.*
3. ***Installation:*** *All the products/systems specified in this document shall be installed by a Specialist Applicator approved by the manufacturer strictly in accordance to the written application guide by the manufacturer.*
4. ***Multiple sources and compatibility:*** *Should the Specialist Applicator or the Contractor want to use products from different sources, they shall submit proof of compatibility between those products from different sources.*
5. ***Alternate equivalents:*** *Should the Specialist Applicator or Contractor prefer to use alternative product(s) equivalent to the approved list in Section E, it can only be after obtaining a written approval by the specifier; such approvals for alternative systems can only issued by the specifier after ascertaining conformity to the specified key performance properties.*
6. ***Substrate preparation:*** *Before starting to install the specified waterproofing system, the substrate shall be jointly inspected by the Contractor and the Specialist Applicator for soundness; any defects shall first be repaired utilising products and systems compatible with the specified waterproofing system.*

C. Waterproofing System (Internal & External)

The specified waterproofing system for Toilet sunken area comprises of the following and each generic product specified shall meet the key performance properties in section D.

. **Coving with high dispersion SBR Latex ensuring higher mixing efficiency with water reduction for site batched mortar**

1. **Drain Water Pipe hole sealing with Non-Shrink cementitious grout filling annuals space between pipe and concrete**
2. **Waterproof coating for Sunken with Elastomeric acrylic reinforced cementitious coating for concrete.**
3. **Protection Screed with low dosage liquid integral waterproofer for mortar**
4. **Tile Adhesive Highly Polymer Modified Grey Coloured Cementitious Tile adhesive**.
5. **Epoxy resin based tile grout used to fill the joints between tiles**.

D. APPROVED PRODUCTS

	Type of product	***Approved products***	***Manufacturer***
1	High Dispersion SBR Latex	MasterEmaco SBR 2	BASF
3	Non-shrink, cementitious grout	MasterFlow 718	BASF
4	Elastomeric acrylic reinforced cementitious waterproofing Coating	Masterseal 551	BASF
5	Low Dosage liquid integral waterproofer	MasterPel 707	BASF
6	Highly Polymer Grey Coloured Tile Adhesive	MasterTile 30	BASF
7	Epoxy resin Tile Grout	MasterTile 100	BASF

F Application:

Please refer to the Method Statement for preparation, mixing, application and finishing details, as per the manufacturer. This will be submitted based on the site condition after receiving the order but before the commencement of the application job

G Testing

The Contractor shall ensure, by testing if necessary, that the products meet the specified key properties, before their installation by the applicator.

If any seepage of water noticed in the structure, the applicator shall make good those areas by an approved method, and re-inspect to the satisfaction of the Architect /Consultant

Specification for Internal Protection to concrete and Steel Structures in waste water treatment plants

A. Notes to specifiers

Scope: This specification covers Internal protection to concrete and steel structures exposed to municipal and Industrial wastewater to resist deterioration from rebar corrosion caused by carbonation, chloride ion ingress, released gases, various organic and Inorganic acids, Specifically Biogenic corrosion attack and other extremely corrosive exposure conditions

B. General

Quality assurance: All products in the system shall meet the key performance properties listed in Section D against each and shall be sourced from a manufacturer with a certified QA system such as, ISO 9001 or an established and proven QA system that has ensured consistent products.

Approved sources: All products in the specified system shall be sourced from a single manufacturer, from amongst the list of approved products and sources for each in Section E.

Installation: All the products/systems specified in this document shall be installed by a Specialist Applicator approved by the manufacturer strictly in accordance to the written application guide by the manufacturer.

Multiple sources and compatibility: Should the Specialist Applicator or the Contractor want products from different sources, they shall submit proof of compatibility between the products of different sources.

Alternate equivalents: Should the Specialist Applicator or Contractor prefer to use alternative equivalent product(s) to the approved list in Section E, it can only be after obtaining a written approval by the Specifier for use of the preferred alternative; such approvals can only issue by the Specifier after establishing conformity to the specified key performance properties as mentioned in section D.

Substrate preparation: Before starting to install the specified protection system, the substrate shall jointly be inspected by the Contractor and the Specialist Applicator for soundness; any defects shall first be repaired utilising products and systems compatible with the specified system.

C. Internal Protection to Concrete Structures

The specified protection system for concrete shall comprise of the following system, each generic product specified shall meet the key performance properties in section D.

1. Chemical resistant, moisture tolerant, crack bridging Primer cum bond promoter for concrete:

Primer to be used shall be a two-component primer based on Xolutec - Technology, providing high substrate penetration and acting as bond promoter for subsequent top coat.

2. Chemical Resistant moisture tolerant, crack bridging top Coat: Internal protection to concrete and steel exposed to aggressive waste water shall consist of a two component, crack bridging coating having specific chemical resistance to biogenic corrosion and to other organic and inorganic chemicals from Industrial and municipal wastewater. System shall be moisture tolerant and applicable by spray as well as by roller.

- Substrate shall be prepared using captive shot blasting and / or diamond grinding as required to remove all contamination and provide a clean, sound substrate suitable to receive the product.

- Repairs to the substrate and other works must be completed using the appropriate Master Builders Solutions repair products in good time prior to the application. All surfaces to be coated must be sound, firmly fixed, clean, visible dry, smooth and free from voids or protrusions.
- Prepared substrate will be primed using MasterSeal P770 (see manufacturer datasheet).

- MasterSeal M 790 waterproofing membrane will be hand or spray applied using a brush, a roller or specific spraying equipment (see manufacturer datasheet).

- All materials are to be mixed and installed in accordance with the manufacturer's instructions and good site practice.

Primer: One coat at a minimum thickness of 0.20 to 0.30mm

Top Coat: Two coats to form a total thickness of 0.80 mm

Note: The system consisting of primer and coating of similar specifications and nature as mentioned in this document shall have a **"proof of performance"** in biogenic corrosion exposure conditions by a recognised external testing institute of National or International repute

D. Approved products

The following products from their respective manufacturer for each type of product meet the specified key properties in Section D and are approved for use in this application.

Sl.No	Type of product	Approved products	Manufacturer
1	2-Component, highly chemical resistant, crack bridging, moisture tolerant protective coating membrane based on Xolutec Technology	MasterSeal P 770	BASF
2	2-Component, moisture tolerant primer based on Xolutec Technology	MasterSeal M 790	BASF

Required approvals for the product:

- Long term resistance against biogenic sulfuric acid corrosion.

- Compliance with EN 1504 part 2 according to following principles:
    - Principle 1.2 Protection against ingress. Surface coating with crack bridging ability.
    - Principle 2.2 Moisture control. Surface coating.
    - Principle 5.1 Physical resistance. Coatings.
    - Principle 6.1 Resistance to chemicals. Overlays and coatings.
    - Principle 8.2 Increasing resistivity by limiting moisture content by surface treatments (coatings).

Delivery of CE marking documents (Declaration of Performance) is mandatory.

Required certifications for the supplying company:

The product should be manufactured by a company certified to conform to the requirements of the quality, environmental and occupational health & safety standards ISO 9000 series and ISO 14001.

Required qualifications for the application company:

- Company with minimum of 5 years' experience in application of specified products and systems on projects of similar size and scope. (Optionally: successful completion of a minimum of 5 projects of similar size and complexity to specified work.).

- Approval or certification (including specific training) by the product manufacturer of the material.

E. Application

Applicator shall apply each product strictly as per the written application guidelines by the manufacturer at the consumption rates as per the manufacturers technical datasheets. Detailed methodology will be provided by the applicator on receipt of work order but before commencement of the application job.

Description	**Value**
Application temperature (substrate and material)	from +5 to +35°C
Maximum substrate moisture (during application)	not restricted, but surface must be visibly dry
Maximum relative humidity (during the application)	not restricted, but there should be no condensation on the surface

J. *Application:*

Please refer to the Method Statement for preparation, mixing, application and finishing details, as per the manufacturer. This will be submitted based on the site condition after receiving the order but before the commencement of the application job

K. *Testing*

The Contractor shall ensure, by testing if necessary, that the products meet the specified key properties, before their installation by the applicator.

If any seepage of water noticed in the structure, the applicator shall make good those areas by an approved method, and re-inspect to the satisfaction of the Architect /Consultant.

VIII .SPECIFICATION FOR ALUMINIUM AND GLAZING WORKS

(Applicable for all Items of work as per BOQ Ref Item no. I (1)(2) (8)(9) (10) (14) (15))

Aluminium Sliding Windows:"Design, Fabricate, deliver (to job site) and install Sliding system M/s. SCHUECO TROP TEC/ REYNAERS/ KAWNEER.The outer frame and vent frame should be made of Aluminium Alloy 6063-T6 or 6060-T66 with a vent (shutter) depth of 39mm. The outerframe is miter-joined with rigid corner cleats. The vent frame can be square cut or miter joined. The vertical vent frames shall have a minimum depth of 39mm and the horizontal vent frames shall have a minimum depth of 35.4mm. The track must be removable. Provision for retro-fitting of flyscreen without any additional mechanically fixed track should be provided. All reinforcements if any should be concealed and on the outside. Room side concealed reinforcement will be acceptable where flyscreen is not required. Single point or multi-point depending upon the tested criteria is acceptable. Where multi-point locking is required due to testing parameter, demonstration on maintenance and serviceability is required.
The vertical member should not deflect more than L/175 or 19mm, whichever is the least for the project wind load. Deflection calculation should be based upon moment distribution. The system should have already been tested/accredited by an international independent testing laboratory. The system should comply with an Air infiltration requirement of 300 Pa when tested in accordance with EN 1026, Static water penetration of 300 Pa in accordance with EN 1027 and 1.2kPa of wind load for 50 cycles. The system should also comply with a proof load of 1.5 times design wind load."
i) Extrusions: Only virgin billets (from certified billet suppliers) should be used for extrusion for consistent mechanical & chemical properties. Only fully homogenised aluminium billets should be used for high surface finish. Aluminium extrusions should comply with dimensional tolerances as per EN-12020-2 standards. Aluminium alloy

to be either 6063-T6 or 6060-T66 with chemical composition as per EN-755-2. Extrusion chemical composition and mechanical property testing from production run has to be submitted.
ii) Gaskets: Gaskets to be of system supplier make/brand. All gaskets to be designed specifically for the particular application and should be designed and supplied by the aluminium system supplier. All gaskets to be long life peroxide cured EPDM. Gaskets must be formed in a complete frame with sealed joints. Gaskets should comply with dimensional tolerances as per ISO-3302-1 or EN-7715. Gasket composition should be as per EN-7863. All gaskets/ weatherseals/ spacers are to have continuous mechanical attachment to framing members. Adhesive attachment is not acceptable.
iii) Cleats: Cleats to be of system supplier make/brand. All 45 degree miter joints to be provided with extruded or cast corner cleats. Screwed corner cleats should have designed grooves for receiving screws. System supplier should supply permanently elastic silicone based sealant for the corner joint. Nailed corner cleats should have designed grooves for receiving nails. System supplier should supply two part metal adhesive for assembling the nailed corner joints. Corner cleats for crimping should be assembled after application with permanently elastic silicone based sealant.
v) Fixings and fasteners: Fixing and fasteners shall comply with BS EN ISO 3506-1:2009 and BS EN ISO 3506-2. Unless noted otherwise, grade A4 should be used for visible fasteners and in wet areas, in all other circumstances grade A2 should be used. All shims to be capable of transferring the load evenly and made of a suitable material (GI, Teflon etc) capable of lasting the life span of the system.
vi) Temporary protection: All coated surfaces vulnerable to damage during handling and installation or by subsequent site operations should be fully protected for the duration of the works. Protective coverings should be resistant to all weathers. They should be partially removable and replaceable for access to fixing points during installation and/or subsequent site operations. Any protective tapes used in direct contact with the coating should be a low tack, self-adhesive type in white or any colour lighter than the coating to be covered.
vii) Weather sealing: The brush seals should have two layers of plastic fins for required weather sealing and should be of system suppliers make/brand. All interlock and meeting stile locations should be provided with center seals at top and bottom.
viii) Security: Anti-lift out device of system company make/brand shall be provided. Flush or lever handle in single or multi-point locking as required by client.
ix) Rollers: The rollers should be of system company make/brand. The rollers must be tested for durability – minimum of 20,000 cycles.
x) Sealants and adhesives: All sealants and adhesives used within system to be of system company make/brand and specified for the particular application.
Surface finish (powder coating): All aluminum surfaces exposed to view under indoor circumstances shall receive a factory applied, oven-cured powder coating. Provide powder coating with average thickness of 60 microns in visible areas. 10 years warranty in accordance to AAMA standards. Approved suppliers are Jotun/AkzoNobel. Shade and finish as approved by architect. (Powder Coating shade Code Shall be RAL 7005/Equivalent) (D.R)
Glass : 8mm thk clear toughened glass of Saint Gobain/Ashai/ Atultuf

Aluminium Tophung/ Side Hung Windows: "Aluminium side hung/top hung outward openable window system: Design, Fabricate, deliver (to job site) and install window system Schüco TropTec/REYNAERS/Kawneer. Extra for top/casement openable window shutter over Fixed window item(only shutter area will be measured) The system has to be pressure equalised, ventilated and drained. The outer frame shall have a depth designed as per applicable wind load. The outerframes can be square or mitre joined as per structural and architectural requirements. The outerframe cruciform connections shall have t-cleat reinforcement. The ventframes should be 45 degree miter-joined with a minimum depth of 40mm. The windows are locked with multipoint locking. Opening restrictor should be provided.
The vertical member should not deflect more than L/175 or 19mm whichever is the least for the applicable wind load (positive and negative). The horizontal member should not deflect more than 3mm due to dead load and 15mm due to applicable wind load (positive and negative). The system should have already been tested/accredited by an international independent testing laboratory. The system should comply with an Air infiltration requirement of 300 Pa when tested in accordance with EN 1026, Static water penetration of 300 Pa in accordance with EN 1027. The system should be capable of passing a repeat air infiltration of 300 Pa, Static water of 300 Pa after design load. The system should also comply with a proof load (±1.5 times design load). "
i) Extrusions: Only virgin billets (from certified billet suppliers) should be used for extrusion for consistent mechanical & chemical properties. Only fully homogenised aluminium billets should be used for high surface finish. Aluminium extrusions should comply with dimensional tolerances as per EN-12020-2 standards. Aluminium alloy

to be either 6063-T6 or 6060-T66 with chemical composition as per EN-755-2. Extrusion chemical composition and mechanical property testing from production run has to be submitted.
ii) Gaskets: Gaskets to be of system supplier make/brand. All gaskets to be designed specifically for the particular application and should be designed and supplied by the aluminium system supplier. Inner gaskets must be formed in a complete frame with sealed joints. Gaskets should comply with dimensional tolerances as per ISO-3302-1 or EN-7715. Gasket composition should be as per EN-7863. All gaskets/ weatherseals/ spacers are to have continuous mechanical attachment to framing members. Adhesive attachment is not acceptable.
iii) Cleats: Cleats to be of system supplier make/brand. All 45 degree miter joints to be provided with extruded or cast corner cleats. Screwed corner cleats should have designed grooves for receiving screws. System supplier should supply permanently elastic silicone based sealant for the corner joint. Nailed corner cleats should have designed grooves for receiving nails. System supplier should supply two part metal adhesive for assembling the nailed corner joints. Corner cleats for crimping should be assembled after application with permanently elastic silicone based sealant.
iv) Screws: Screws to be of system supplier make/brand. All screws to be minimum grade 304 stainless steel.
v) Fixings and fasteners: Fixing and fasteners shall comply with BS EN ISO 3506-1:2009 and BS EN ISO 3506-2. Unless noted otherwise, grade A4 should be used for visible fasteners and in wet areas, in all other circumstances grade A2 should be used. All shims to be capable of transferring the load evenly and made of a suitable material (GI, Teflon etc) capable of lasting the life span of the system.
vi) Temporary protection: All coated surfaces vulnerable to damage during handling and installation or by subsequent site operations should be fully protected for the duration of the works. Protective coverings should be resistant to all weathers. They should be partially removable and replaceable for access to fixing points during installation and/or subsequent site operations. Any protective tapes used in direct contact with the coating should be a low tack, self-adhesive type in white or any colour lighter than the coating to be covered.
vii) Barrel hinges: The hinges and associated fixing accessories should be of system supplier make/brand. The hinges should be specified by supplier/system company for the specific vent weight, size and opening limitation. The hinges should be tested and certified for a minimum of 10,000 cycles.
viii) Locking mechanism, hardware and security: Lever handles and espagnolettes to be of system supplier make/brand. All screws and other associated fasteners should be minimum Grade 304 stainless steel. Multipoint locking should be provided. Opening limiter to be provided.
Surface finish (powder coating): All aluminum surfaces exposed to view under indoor circumstances shall receive a factory applied, oven-cured powder coating. Provide powder coating with average thickness of 60 microns in visible areas. 10 years warranty in accordance to AAMA standards. Approved suppliers are Jotun/AkzoNobel. Shade and finish as approved by architect. (Powder Coating shade Code Shall be RAL 7005/Equivalent) (D.R)

Aluminium Fixed windows: "Aluminium fixed window system: Design, Fabricate, deliver (to job site) and install window system Schüco TropTec /REYNAERS/Kawneer.The system has to be pressure equalised, ventilated and drained. The outer frame shall have a depth designed as per applicable wind load. The outerframes can be square or mitre joined as per structural and architectural requirements. The cruciform connections shall have t-cleat reinforcement.
The vertical member should not deflect more than L/175 or 19mm whichever is the least for the applicable wind load (positive and negative). The horizontal member should not deflect more than 3mm due to dead load and 15mm due to applicable wind load (positive and negative). The system should have already been tested/accredited by an international independent testing laboratory. The system should comply with an Air infiltration requirement of 300 Pa when tested in accordance with EN 1026, Static water penetration of 300 Pa in accordance with EN 1027. The system should be capable of passing a repeat air infiltration of 300 Pa, Static water of 300 Pa after design load. The system should also comply with a proof load (±1.5 times design load). "
i) Extrusions: Only virgin billets (from certified billet suppliers) should be used for extrusion for consistent mechanical & chemical properties. Only fully homogenised aluminium billets should be used for high surface finish. Aluminium extrusions should comply with dimensional tolerances as per EN-12020-2 standards. Aluminium alloy to be either 6063-T6 or 6060-T66 with chemical composition as per EN-755-2. Extrusion chemical composition and mechanical property testing from production run has to be submitted.
ii) Gaskets: Gaskets to be of system supplier make/brand. All gaskets to be designed specifically for the particular application and should be designed and supplied by the aluminium system supplier. Inner gaskets must be formed in a complete frame with sealed joints. Gaskets should comply with dimensional tolerances as per ISO-3302-1 or EN-7715. Gasket composition should be as per EN-7863. All gaskets/ weatherseals/ spacers are to have continuous mechanical attachment to framing members. Adhesive attachment is not acceptable.

iii) Cleats: Cleats to be of system supplier make/brand. All 45 degree miter joints to be provided with extruded or cast corner cleats. Screwed corner cleats should have designed grooves for receiving screws. System supplier should supply permanently elastic silicone based sealant for the corner joint. Nailed corner cleats should have designed grooves for receiving nails. System supplier should supply two part metal adhesive for assembling the nailed corner joints. Corner cleats for crimping should be assembled after application with permanently elastic silicone based sealant.
iv) Screws: Screws to be of system supplier make/brand. All screws to be minimum grade 304 stainless steel.
v) Fixings and fasteners: Fixing and fasteners shall comply with BS EN ISO 3506-1:2009 and BS EN ISO 3506-2. Unless noted otherwise, grade A4 should be used for visible fasteners and in wet areas, in all other circumstances grade A2 should be used. All shims to be capable of transferring the load evenly and made of a suitable material (GI, Teflon etc) capable of lasting the life span of the system.
vi) Temporary protection: All coated surfaces vulnerable to damage during handling and installation or by subsequent site operations should be fully protected for the duration of the works. Protective coverings should be resistant to all weathers. They should be partially removable and replaceable for access to fixing points during installation and/or subsequent site operations. Any protective tapes used in direct contact with the coating should be a low tack, self-adhesive type in white or any colour lighter than the coating to be covered.
Surface finish (powder coating: All aluminum surfaces exposed to view under indoor circumstances shall receive a factory applied, oven-cured powder coating. Provide powder coating with average thickness of 60 microns in visible areas. 10 years warranty in accordance to AAMA standards. Approved suppliers are Jotun/AkzoNobel. Shade and finish as approved by architect. (Powder Coating shade Code Shall be RAL 7005/Equivalent) (D.R)
Glass : 8mm thk clear toughened glass of Saint Gobain/Ashai/ Atultuf/Arihant

LIST OF APPROVED MAKE OF MATERIALS – ALUMINIUM / GLAZING WORKS

1.	**Aluminium Extrusions**	**:** Jindal, ECIE, Hindalco, Bhoraka/ Equivalent
2.	**Glass (Float)**	**:** Saint Gobain, Pilinkgton, Ashai, Atultuf, Arihant
3.	Polysulphide Sealant	: **Tuffseal, Pedilite, Choksey, Fosroc**
4.	Silicone Sealant	: **GE Silicones, Dow Corning, Wacker**
5.	Door Closer / Floor Springs	: **Dorma / Ozone / Hafele.**
6.	Masking Tapes	: **Sun-control / Wonder Polymer / equivalent**
7.	Stainless Steel Screws for **Fabrication and fixing of Windows**	**:** Kundan, Puja, Atul
8.	Treatment of MS Brackets	: **Galvanised Brackets as per IS:4759-1996** : **610 gms/sqm (microns) 80-90**
9.	Dash Fasteners / Anchor Bolts	: **Hilti, Fischer, Bosch.**
10.	Stainless Steel Bolts, Washers and Nuts.	: **Kundan, Puja, Atul**
11.	Stainless Steel Pressure Plate Screws	: **Kundan, Puja, Atul**
12.	Stainless Steel Friction Stay / **Aluminium Die-cast handles &** Two point locking kit	: **Glesse, Securitystyle, Alu-alpha**
13.	E.P.D.M. Gaskets	: **Anand Reddiplex, Enviro Seals**
14.	PVC continuous fillet for periphery Packing of Glazing / Structural Glazing	: : **Roop, Anand, Forex Plastic.**
15.	Aluminium Cleat arrangement for Glazings	: : **Deco or approved equivalent.**
16.	Door Locks	: **ACME, Godrej, Harrison**
17.	Door Seal	: **Woolpile Weather Strip : Anand – Reddiplex**
18.	Stainless Steel D-handles	: **Dorma, Ozone, Hafele**

NOTE: PRIOR APPROVAL TO BE TAKEN FOR USE OF ANY OF THESE ITEMS.

NOTES FOR ALUMINIUM WORKS

PS: THIS NOTES SHALL BE READ ALONG WITH THE COMMON SPECIFICATIONS AND THE DETAILED ITEM SPECIFICATIONS:

Unless otherwise specified the rate quoted for all items shall include the cost of the following:

a. Cost of all materials, fabrication, transportation and labour.

b. Work at all levels, heights and locations.

c. Providing scaffolding, platforms, ladders and removing.

d. Fixing with necessary TW plugs and cadmium plated brass screws and/or anchor fasteners /bolts as directed in masonry and/or concrete openings.

e. Breaking the floor/RC slab to fix frames, floor springs, etc; and making good the surface.

f. Painting the sections with a thick coat alkali resistant bituminous paint for faces coming into contact with masonry, concrete, plaster or any dissimilar materials.

g. Protecting the sections with tape and/or grease from cement.

h. Filling the gaps between the frames and plastered surface with approved quality mastic cement.

i. Unless otherwise specified sections shall be natural anodized matt finish to a minimum thickness of 20 micron.

j. Clips, EPDM gaskets for sealing and weather strips.

k. Door shutter shall consist of concealed mortise locks of approved make, concealed tower bolts, locking arrangements.

l. The windows and ventilators shall have approved fittings like handles, locking arrangements and peg stays.

m. Glazing with minimum 5 mm clear plain glass where unsupported glazing area is 1.5 sqm and less and minimum 6 mm clear plain glass where the unsupported glazing area is more than 1.5 Sqm.

n. Cleaning the frames, glass, grills and floor and leaving the premises clean and tidy.

o. Providing flawless glass without waviness, bubbles, scratches, etc;

p. Unless otherwise specified sections shall be Powder Coated matt finish to a minimum thickness of 60 micron. As and when the materials are supplied the vendor to prove the thickness of powder coating using the Ultrasound testing equipments.

q. Structural Stability of the glazing system needs to be guaranteed by authorized structural engineer to be provided by vendor.

The hardware used shall be of approved range and hinges shall be security style SS hinges

TECHNICAL SPECIFICATIONS FOR GYPSUM/CALCIUM SILICATE CEILING WORKS (APPLLICABE TO BOQ ITEM NO V (1))

MODULAR FALSE CEILING

Materials shall be of the best-approved quality obtainable and they shall comply with the respective latest Standard Specifications. Samples of all materials shall be got approved before placing order and the approved sample shall be deposited with the Project consultants, which will be displayed at site as a control sample. In case of non-availability of materials in metric sizes, the nearest size in FPS units shall be provided with the prior approval of the Project consultants for which neither extra will be paid nor any rebate shall be recovered.
If directed, materials shall be tested in any approved Testing Laboratory and the test certificate in original shall be submitted to the Project consultants and, the entire charges connected with testing including charges for repeated tests if ordered, shall be borne by the Contractor. The Contractor without any extra cost shall provide all equipment and facilities for carrying out field tests on materials if asked by the Project consultants.
It shall be obligatory for the Contractor to furnish certificates, if demanded by the Project consultants, from manufacturer or the material supplier that the work has been carried out by their material and as per their recommendations and specifications. The rates quoted for all items in this schedule shall be applied to the work pertaining to that item in all floors whether specifically mentioned or not.

HYDRATED CALCIUM SILICATE & FIBRE MODULAR FALSE CEILING SYSTEM

TILES

Modular false ceiling tiles shall be of the following material composition and specification of recommended make.
Size of the boards: 600 x 600 x 15mm
Edge Style : Tegular suitable for 24 OR 15mm T grids
NRC : In the range of 0.10 - 0.50
Fire performance: Class O/ Class 1 as per BS 476
Relative humidity : In the range of 100%
Light Reflectance : Greater than - 85 %
Colour : White or to shade as approved by Project consultants.
Material Composition: Hydrated Calcium Silicate with reinforcing fibers and natural fibers with-out formaldehyde and other harmful toxic ingredients.

SUSPENSION SYSTEM AND PROCEDURE OF WORKS

Supply and installation of suspension grid system with main Tee and cross Tees to provide a stable suspension system for quick laying of acoustic ceiling tiles of nominal size 600 mm x 600 x 19/ 15 mm. The width of flange of all Tees shall be 15 mm as per the manufacturer's specification. The Tees shall be double webbed with bake enamelled fascia cap and all other exposed surfaces galvanized or suitably treated against corrosion. Free ends of tees shall be mounted with quick release high tensile spring steel clips to provide a plug-in positive-lock for easy removal without tools. Suspension points shall not exceed centre-to-centre distance of 1200 ~ 1250 mm and shall be professionally executed with twin 4-mm GI suspension rods and adjustable suspension clip of spring steel. The entire grid system shall be designed to bear a distributed load of minimum 18 kg/sqm.

NOTES:

The rate quoted for any of the Modular false ceiling system shall include providing necessary cut-outs for all Light fixtures (all sizes), AC diffuser, AC dampers, AC linear grilles, smoke detectors, speakers etc., and any other openings to be made in the false ceiling as directed by the Project consultants. There will not be separate measurements for the vertical drops upto 600mm high, double level ceiling, vaulted ceiling, curved ceiling, inclined ceiling, and indirect lighting made in Modular false ceiling works. There will not be additional rates/ measurements for the above cut-outs to be provided in the ceiling.
Deductions will be made for the areas where tiles are not installed due to fixing of Light fixtures and AC diffusers. (Only the suspension system cost will be paid for these areas) Cut tiles will not be considered or measured as full tiles for the measurements. As such the payment shall be made on actual laid areas immaterial of cut or full tiles. Deductions for columns areas in false ceiling shall be made based on the final dimension of columns after cladding/ paneling. There will not be any additional rates/ measurements for the making the machine made painted Tegular edge for all the cut tiles to be laid in the ceiling.
The quantities indicated in the BOQ are excluding the attic stock. The order placement quantity shall be inclusive of adequate quantity for attic stock as/ if required. Please note false ceiling support system shall be

suspended from the true RCC ceiling irrespective of height between false ceiling and true RCC ceiling. In case double height ceiling, if the height between false ceiling and true RCC ceiling is not adequate to support the false ceiling system from the true RCC ceiling, the intermediate MS powder coated box section framework shall be created and the false ceiling suspenders are to hung and supported from the MS powder coated framework. There will not be additional costs paid towards the same for fabrication with material and erection of it at site with necessary anchor bolts as required for the MS powder coated framework.

GYPSUM FALSE CEILING WORKS

GENERAL

Design of grid layout shall be produced with co-coordinating suspension points in tandem with other service duct / cable tray layouts. The grid layout is to be superimposed on the ceiling service ducting / cabling layout and got approved from the Project consultants.

SUSPENSION SYSTEM & MATERIAL: The false ceiling shall include providing and fixing GI perimeter channels of size 0.55 mm. Thick. having one flange of 20 mm and another flange of 30 mm and web of 27 mm along the perimeter of the ceiling, screw fixed to brick wall/ partition with help of nylon sleeves and screws, at 610 mm centers. The suspended GI intermediate channels of size 45 mm, 0.9mm thk with two flanges of 15 mm each from the soffit at 1220 mm centers with ceiling angles with ceiling angle of width 25mm x 10mm x 0.55mm thk fixed to soffit with GI cleat and steel expansion fasteners. Ceiling section of 0.55 mm thk having web of 51.5 mm and two flanges of 26 mm each with lips of 10.5mm are then fixed to the intermediate channels with help of connecting clips and in direction perpendicular to the intermediate channel with centers. The 12.5 mm tapered edge gyp-board (Confirming to IS-2095-1982) is then screw fixed to ceiling section with 25 mm dry wall screws at 230mm centers. Screw fixing is done mechanically either with screwdriver or drilling machine with suitable attachment.

FINISHING: The boards are to be joined and finished so as to have a flush look which includes finishing the tapered and square edges of the board with joining compound. fibre tape and two coats of primer suitable for Gypboard (As per the recommendations / practice of India gypsum or equivalent).

This includes providing the surface of false ceiling to be painted with approved quality of Plastic emulsion paint. The false ceiling surfaces shall be prepared to the satisfaction of the Project consultant, and shall be applied with two coats of primer, two coats of putty and touch up putty if required to achieve smooth finish. The surface shall be painted with two coats of premium silk emulsion paint of approved make to the satisfaction of Project consultants.

NOTES

1) There will not be separate measurements for the vertical drops upto 2'-0" high, double level ceiling, vaulted ceiling, curved ceiling and indirect lighting made in Gypsum board.

2) False ceiling rate quoted shall include providing necessary cut-outs for fixing Light fixtures (Inclusive of all sizes), AC diffuser, AC dampers, AC linear grilles for (supply and return air), smoke detectors, speakers etc., as directed by the Project consultants. (No additional rates will be given for the cut-outs).

SPECIFICATIONS FOR MODULAR FALSE CEILING WORKS

Materials shall be of the best-approved quality obtainable and they shall comply with the respective latest Standard Specifications. Samples of all materials shall be got approved before placing order and the approved sample shall be deposited with the Project consultants, which will be displayed at site as a control sample.

In case of non-availability of materials in metric sizes, the nearest size in FPS units shall be provided with the prior approval of the Project consultants for which neither extra will be paid nor shall any rebate be recovered.

If directed, materials shall be tested in any approved Testing Laboratory and the test certificate in original shall be submitted to the Project consultants and, the entire charges connected with testing including charges for repeated tests if ordered, shall be borne by the Contractor. The Contractor without any extra cost shall provide all equipment and facilities for carrying out field tests on materials if asked by the Project consultants.

It shall be obligatory for the Contractor to furnish certificates, if demanded by the Project consultants, from manufacturer or the material supplier that the work has been carried out by their material and as per their recommendations and specifications. The rates quoted for all items in this schedule shall be applied to the work pertaining to that item in all floors whether specifically mentioned or not.

MINERAL FIBRE MODULAR FALSE CEILING SYSTEM

TILES

Modular false ceiling tiles shall be of the following material composition and specification of recommended make.

Size of the boards : 600 x 600 X 19/15mm (Based on BOQ item)
Edge Style : Tegular suitable for 15mm wide'' T ''grids
NRC : In the range of 0.55 - 0.90 (Based on BOQ item)
CAC : In the range of 35 – 44 dB (Based on BOQ item)
Relative humidity: In the range of 90 – 99 % (Based on BOQ item)
Light Reflectance: Greater than - 80 % (Based on BOQ item)
Colour : White or to shade as approved by Project consultants.
Material Composition: Homogenous mineral fibre comprising slag wood, starch, clay, Guar Gum etc.

SUSPENSION SYSTEM AND PROCEDURE OF WORKS

Supply and installation of suspension grid system with main Tee and cross Tees to provide a stable suspension system for quick laying of ceiling tiles of nominal size 595 x 595/ 600 x 600mm. The width of flange of all Tees shall be 15mm as per the manufacturer's specification.

The Tees shall be double webbed with bake enamelled fascia cap and all other exposed surfaces galvanized or suitably treated against corrosion. Free ends of tees shall be mounted with quick release high tensile spring steel clips to provide a plug-in positive lock for easy removal without tools.

Suspension points shall not exceed centre-to-centre distance of 1200 ~
1250 mm and shall be professionally executed with 4-mm GI suspension
rod and adjustable suspension clip of spring steel. The entire grid system
shall be designed to bear a distributed load of minimum 18 kg/sqm.

False ceiling support system shall be suspended from the true RCC ceiling irrespective of height between false ceiling and true RCC ceiling and due to any constraints by means of Services like AC ducts, Electrical Cable trays, Raceways etc. In case of double height ceiling and any constraints as stated above, if the height between false ceiling and true RCC ceiling is not adequate to support the false ceiling system from the true RCC ceiling, the intermediate MS powder coated box section framework shall be created and the false ceiling suspenders are to hung and supported from the MS powder coated framework. There will not be additional costs paid towards the same for the fabrication with material and erection of it at site with necessary anchor bolts as required for the MS powder coated framework.

Shop drawing shall be produced with co-ordinating suspension points in tandem with other Services layouts. The Contractors to start the works only on written approval by the Project consultants on the Shop drawings submitted.

Design of grid layout shall be produced with co-ordinating suspension points in tandem with other service duct / cable tray layouts. The grid layout is to be superimposed on the ceiling service ducting / cabling layout and got approved from the Project consultants.

MODULAR FALSE CEILING ACCESSORIES

Supply and Installation of all Modular False ceiling accessories like Floating ceiling Perimeter trims, Bandmasters and Axiom Trims shall be of Proprietary make made in pre-fabricated aluminium to size and shape as per the manufacturer's specifications adhering to detail drawings as indicated in the Bill of Quantities.

Notes:

- The rate quoted for any of the Modular false ceiling system shall include providing necessary cut-outs for all Light fixtures (all sizes), AC diffuser, AC dampers, AC linear grilles, smoke detectors, speakers etc., and any other openings to be made in the false ceiling as directed by the Project consultants. There will not be additional rates/ measurements for these cut-outs provided in the ceiling. Where ever the tiles are required to be cut these shall be of the machine made, painted, and finished to get like company made Tegular edge profiles.

- There will not be separate measurements for the vertical drops upto 600mm high, double level ceiling, vaulted ceiling, curved ceiling, inclined ceiling, and indirect lighting made in Modular false ceiling works.

- There will not be additional rates/ measurements for the above cut-outs to be provided in the ceiling.

- Deductions will be made for the areas where tiles are not installed due to fixing of Light fixtures and AC diffusers. (Only the suspension system cost will be paid for these areas)

- Cut tiles will not be considered or measured as full tiles for the measurements. As such the payment shall be made on actual laid areas immaterial of cut or full tiles.

- Deductions for columns areas in false ceiling shall be made based on the final dimension of columns after cladding/ paneling.

- There will not be any additional rates/ measurements for the making the machine made painted Tegular edge for all the cut tiles to be laid in the ceiling.

- The quantities indicated in the BOQ are excluding the attic stock and wastage. The order placement quantity shall be inclusive of adequate quantity for attic stock and wastage as/ if required. Contractors to quote the unit rate to include wastage component after careful study of the Tender drawings and site visits.

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GENERAL NOTE FOR ALL CONTRACTORS: THE ARCHITECTS/CONSULTANTS HAVE RECOMMENDED CERTAIN MAKES/MODELS/BRANDS OF PRODUCTS/MATERIALS AVAILABLE IN THE MARKET. THESE ARE MENT AS A GUIDE TO THE CONTRACTOR. IT IS TO BE UNDERSTOOD BY THE CONTRACTOR THAT WHERE SUCH RECOMMENDED MATERIALS ARE NOT AVAILABLE IN THE MARKET AS PER THE MANUFACTURER, THE CONTRACTOR SHALL RECOMMEND ALTERNATE MATERIALS/PRODUCTS MEETING THE REQUIREMENTS IN ALL RESPECTS. THE ARCHITECTS/CONSULTANTS MAY AT THEIR SOLE DISCREATION ACCEPT OR REJECT SUCH PROPOSAL FOR ALTERNATIVES.

LIST OF APPROVED MAKE OF MATERIALS

1.	**CEMENT**	**43/53 Grade OPC ACC, L&T (ULTRATECH), RAJASREE, ZUARI, COROMANDEL, BIRLA SUPER, JK Cement, Bharathi, Dalmia.**
2.	**REINFORCEMENT STEEL**	**TISCO, SAIL, VIZAG, JSW (Primary Steel)**
3.	**STRUCTURAL STEEL**	**TISCO, SAIL, VIZAG,JSW**
4.	**TUBULAR STEEL**	**TATA, GUJARAT STEEL, ZENITH, APOLLO.**
5.	**ALUMINIUM ROOFING & CLADDING SHEETS**	**JINDAL, HINDALCO**
6.	**M.S ROOFING, DECKING & CLADDING SHEETS**	**TI METAL, NIPPON DENRO, TRACDECK**
7.	**PREPAINTED SHEETS**	**METACOLOR, NIPPON DENRO, TRACDECK, JAPAN METALI.**
8.	**POLYCARBONATE SHEETS**	**GE PLASTICS.**
9.	**ALUMINIUM EXTRUSIONS**	**JINDAL, HINDALCO, BHORUKA.**
10.	**VINYL FLOORING SHEETS**	**PREMIER VINYL, ARMSTRONG, BHOR, L.G.**
11.	**VITRIFIED TILES**	**KAJARIA, NITCO,RAK,JOHNSON,SOMANY**

1. **12. CEMENT TILES**	**EUROCON, ULTRA TILE, BASANTH BATON**
13. GLASS (SHEET)	**ATUL, SAINT GOBAIN, PILKINGTON, ASAHI. Arihant**
14. GLASS (FLOAT)	**MODIGLASS, SAINT GOBAIN, ATUL TUF, PILKINGTON. Arihant**
15. POLYSULPHIDE SEALANT	**TUFFSEAL, PEDILITE, CHOKSEY, FOSROC.**
16. SILICONE SEALANT	**GE SILICONES, DOW CORNING, DUPONT RODOSIL, ANABOND.**
17. READY MIX PAINTS	**ASIAN PAINTS, GOODLASS NEROLAC, BERGER, JOHNSON & NICHOLSON.**
18. CEMENT PAINTS	**SUPER SNOWCEM, SANDTEX MATT, BERGER PAINTS.**
19. INDUSTRIAL PAINTS	**GOODLASS NEROLAC, BERGER, ASIAN, SHALIMAR.**
20. DOOR CLOSER	**DORMA / SEVAX.**
21. FLOOR SPRING	**DORMA / SEVAX.**
22. MORTICE LOCKS	**GODREJ, GOLDEN, YALE.**
23. PLYWOOD	**DECORATIVE LAMINATES, MYSORE, ARCHID PLY,GREEN PLY, CENTURY PLYWOODS**
24. FLUSH DOOR SHUTTERS	**KUTTY, SHAKTI, GREEN PLY, CENTURY, SOBHA**
25. LAMINATED PARTITIONS	**MERINO, GREEN LAM, CENTURY**
26.ALUMINIUM GLAZING	**SCHUCCO, KAWNEER, REYNAERS.SHADE – RAL 7005)**
27. EXTERIOR SOLID PHENOLIC RAINSCREEN PANELS	**(FUNDERMAX, ROYAL TOUCHE, CENTURY)**
28. WATERPROOFING WORKS	**BASF, FOSROC, PEDILITE,PENETRON**
29. NON SHRINK GROUT & WATERPROOFING COMPOUND	**FOSROC, SIKA, BASF, BAL ENDURA, Webber SGG**
30. GEOTEXTILE MEMBRANE	**SOUTHERN FELT & GEOTEX, SUNTECH GEOTEXTILE, FABRICS AND FABRICS INTERNATIONAL PVT LTD.**
31.WATER STOPPER	**SYNCOFLEX, BASF,FOSROC**
32 GENERAL PURPOSE DOOR	**SHAKTI METAL DOOR, BANGALORE PROTECH CONTROLS PVT LTD, HORMANN (SHADE – OFF WHITE/MORNING GLORY)**

PART B:TECHNICAL SPECIFICATIONS FOR ELECTRICAL WORKS.

INTERNAL ELECTRICAL WORKS

(Applicable for all Items of work as per BOQ Ref Item No. I(1)

1 Scope of Works :

The scope of work shall include all the internal electrical works required for the proposed Hospital project at Bangalore, Karnataka. The scope of work shall include supply, installation, testing and commissioning of all internal electrical works as per Specifications, bill of quantities (BOQ), Drawings and latest IS codes:

4.Internal wiring shall be run through surface /concealed FRLS conduits in basements/ and upto Second floor and with FRLS PVC conduits in all other floors for all the Light points, Ceiling / Exhaust Fan points, Power Socket outlets, Switches with accessories etc.

5.The scope shall also include supply, installation, testing and commissioning of required internal Light fixtures, Ceiling/ Exhaust Fans, Power Socket outlets, Switches along with all fixing accessories required to complete the job as per requirement.

6.FRLS insulated Copper conductor multi stranded flexible wires/ cables sizes for various usages shall be as follows.

Purpose	Size of wire
Light Points from Switch board to point	3Runs 1.5sq.mm
Lighting circuit from DB to switch board	2runs of 2.5sq.mm + 1.5sqmm
6A socket from Switch Point to socket / looping from socket to socket	3runs of 2.5sq.mm
16A socket from DB to socket / looping from socket to socket	3runs of 4sq.mm
20A/ 32 socket from DB to socket	3runs of 6sq.mm
LDB	Cables
PDB & RDB's	Cables
UDB & MDB's	Cables

7.Conduiting and Wiring for UPS powered socket outlets for medical and IT usage, if required.
8.Conduiting and wiring for 3phase sockets outlets from floor electrical rooms.
9.Providing Distribution boards (DB's) in floor electrical rooms to facilitate power for lights, fans, sockets outlets of UPS and normal supply. UPS power supply wiring shall be routed separately, if specfied.
10.UPS supply for DBs of IT usage shall be extended from UPS output panel (IT) at Basement level, if specified.
10.0Contractor has to submit the following before proceeding with work - working/ shop drawings of internal electrification based on tender / working drawings for approval before commencement of work. The works shall be commenced at site only after obtaining necessary approvals
11.0 Contractor has to obtain approvals for the makes of materials, before procurement
12.0Installation working drawings (indicating details of bracket fabrication, requirements of inserts / fan hooks / opening in the civil works, junction boxes, fabrication and erection, fixing details of DB's, hooks/ bracket for fittings, etc.)
13.0Technical details of the lighting fixtures (catalogues, test certificates, etc.).
11.The Complete Wiring shall be tested before energizing and all test certificates shall be submitted for approval
12. Before commissioning, the contractor shall hand over the original tracing along with one reproducible tracing "As Built Drawing" incorporating all the modification / deviations made at site from the original approved plan

INTERNAL ELECTRIFICATION WIRING

(Applicable for all Items of work as per BOQ Ref Item No. I(2)(3)

1 GENERAL:

Technical Specifications in this section cover the Internal Wiring Installations comprising of:
14.0Wiring for lights and convenience socket outlets etc. in conduits
15.0Sub main wiring.
16.0MCB Distribution Boards

2 STANDARDS AND CODES:

The following Indian Standard Specifications and Codes of Practice will apply to the equipment and the work covered by the scope of this contract. In addition the relevant clauses of the Indian Electricity Act 1910 and Indian Electricity Rules 1956 as amended upto date shall also apply. Wherever appropriate Indian Standards are not available, relevant British and/or IEC Standards shall be applicable.

BIS certified equipment shall be used as a part of the Contract in line with Government regulations. Necessary test certificates in support of the certification shall be submitted prior to supply of the equipment.

It is to be noted that updated and current Standards shall be applicable irrespective of those listed below.

IS 694 : 1990 650/1100V	Gade FRLS insulated wires.
IS 9537 : Part I 1980	Rigid Non metal conduits for electrical wiring.
IS 9537 : Part II 1981	Accessories for rigid steel conduits
IS 3837 : 1990	Flexible steel conduits for electrical wiring
IS 3480 : 1990	Switch socket outlets
IS 4615 : 1990	Switches for domestic and similar purposes
IS 3854 : 1997	Boxes for the enclosure of electrical accessories
IS 5133 : Parts I &II 1969	Code of practice for personal hazard fire safety of Buildings
IS 1644: 1998	Code of practice for electrical installation fire safety of buildings
IS 1646 : 1997	Code of practice for electrical wiring installations
IS 732 : 1989	Miniature Air Circuit Breakers for AC Circuits
IS8828:1978	Residual Current Circuit Breakers
IS 12740	Degrees of Protection provided by enclosures for low voltage switchgear
IS 2147 : 1962	Code of Practice for installation and maintenance of switchgear not exceeding 1000 volts
IS 4237 : 1982	General requirements for switchgear and control gear for voltages not exceeding 1000 volts

3 CONDUITS/ RACEWAYS:

3.1 Non Metal Rigid Conduits

These shall be of FRLS PVC heavy gauge type having perfectly circular tubing.

3.2 PVC Conduit Connections

Connections between PVC conduits shall be with proper sealing compound of approved quality and finish. Conduits shall be connected to outlet boxes by means of check-nuts fixed both inside and outside the box. Conduit edges shall be free of burrs and provided with screwed PVC bushes to avoid damage to insulation of conductors while pulling them through the conduits. Connections between M.S. and PVC conduits, if required, shall be through a junction box and never directly.

3.3 Bends

Large right angle bends (more than 75 mm radius) or non right angle bends in conduit runs shall be made by means of conduits bending machines carefully so as not to cause any crack in the conduit. Small right angle bends in conduits runs can be made by standard conduit accessories (solid/inspection bends/elbows) no run of conduits shall have more than four right angle bends from outlet to outlet. Bends in multi runs of conduits shall be parallel to each other and neat in appearance, maintaining the same distance as between straight runs of conduits.

3.4 Conduit Accessories.

3.4.1 Standard accessories

Heavy duty black standard conduit fittings and accessories like standard/extra-deep circular boxes, looping in boxes, junction boxes, normal/ inspection bends, solid/inspection elbows, solid/inspection tees, couplers, nipples, saddles, check nuts, earth clips, ball socket joints etc. shall be of superior quality and of approved makes. Heavy duty covers screwed with approved quality screws shall be used. Superior quality screwed PVC bushes shall be used Samples of all conduits fittings and accessories shall be got approved by Development Manager before use.

3.4.2 Fabricated accessories

Wherever required, outlet/junction boxes of required sizes shall be fabricated from 1.6 mm thick MS sheets excepting ceiling fan outlet boxes, which shall be fabricated from minimum 2 mm thick sheets. The outlet boxes shall be of approved quality, finish and manufacture. Suitable means of fixing connectors etc., if required, shall be provided in the boxes. The boxes shall be protected from rust by zinc phosphate primer process. Boxes shall be finished with minimum 2 coats of enamel paint of approved colour. A screwed brass stud shall be provided in all boxes as earthing terminal.

i) Outlet Boxes For Light Fittings.

These shall be minimum 75mm x 75mm x 50mm deep box/ Round JB's as required and provided with required number of threaded collars for conduit entry. For ceiling mounted florescent fittings, the boxes shall be provided 300 mm off center for a 1200 mm fitting and 150 mm off center for a 600 mm fitting so that the wiring is taken directly to the down rod. 3 mm thick Perspex /hylam sheet cover of matching colour shall be provided.

ii) Outlet Boxes For Ceiling

Outlet boxes for ceiling fans shall be fabricated from minimum 2 mm thick MS sheet steel. The boxes shall be hexagonal in shape of minimum 100 mm depth and 60 mm sides. Each box shall be provided with a recessed fan hook in the form of one 'U' shaped 15mm dia rod welded to the box and securely tied to the top reinforcement of the concrete slab for a length of minimum 150 mm on either side. 3 mm thick Perspex /hylam sheet cover of matching colour shall be provided.

4 Metal Rigid Conduit wiring system:

4.1 All conduit pipes shall be black enameled M.S. conduits with uniform wall thickness. All conduit accessories shall be threaded type in metric system as per IS 2667-1976. No steel conduit less than *20* mm dia shall be used. The thickness shall be 1.6mm upto 32 mm dia. pipes and 2 mm for conduit above 32 mm dia. Separate conduits shall be used for power and lighting circuits.

4.2 Conduit pipes shall be jointed by means of screwed couplers and screwed accessories like junction boxes of depth not less than 65 mm in case of concealed conduits and 50 mm in case of surface conduits. In long distance straight runs of conduit, inspection type couplers at reasonable 8mtrs. Intervals shall be provided. Threads on conduit pipes in all cases shall be between 20mm to 24mm long sufficient to accommodate pipes to full threaded portion of couplers or accessories. Cut ends of conduit pipes shall have no sharp edges nor any burrs left to avoid any damage to the insulation of conductors while pulling them through. Field made threads' are to be protected by applying zinc rich paint-epoxy zinc rich primer (Product of Asian / Garware paints).

4.3 Ebonite bushes shall be used wherever steel conduits are terminated to either junction box, switch socket or any fixture to prevent cuts on wire insulation on any junction box socket outlet or any fixture.

4.4 The outer surface of the conduit pipes including all bends, union', tees, junction boxes etc. forming part of the conduit system shall be adequately protected against rust. In no case bare threaded portion of conduit pipe shall be allowed unless such bare threaded portion is treated with anti-corrosive preservative paint.

4.5 At least 8 SWG G.I. wire shall be laid through the conduit to enable to pull the wires through the conduit.

4.6 For surface conduit wiring, conduit pipes shall be fixed by heavy gauge galvanized M.S. saddles, secured to M.S. galvanized flats of 3 mm thick. The width of flats shall suit the total number of conduits to be run. The conduit pipes shall be individually fixed using galvanized screws, at every 600 mm.

4.7 The junction boxes, and inspection boxes and switch boxes shall be temporarily blocked by jute before the concreting is done and shall be co-ordinated with Architects. After concreting is over, the shuttering is removed, the jute shall be removed and boxes shall be cleaned if they are blocked up by concrete.

4.8 All necessary bends in the system including diversion shall be done bending pipes or by inserting normal or inspection type normal bends or by fixing M.S. Painted inspection boxes whichever is more suitable.

Conduits fittings shall not be used on conduit system exposed to weather. Radius of such bends in conduit pipes shall not be less than 7.5 cm. No length of conduit shall have more than the equivalent of two quarter bends from outlet to outlet Additional bends shall be inspection bends / boxes.

4.9 Junction boxes and down rods for lighting fixtures, shall be of approved make.The boxes shall be complete with covers to be fixed with screws.

4.10 The conduits for concealed wiring in slab or R.C.C. shall be tied to the reinforcement bars by M.S. galvanized wires at every 600 mm apart to give the conduits rigidity. Before installing conduits, junction boxes and inspection boxes in the brick wall, a chase shall be done and shall be co-ordinated with plastering of the walls is done and shall be coordinated with the other Agency. After installing the conduits, the chase shall be closed and shall be finished with the wall.

4.11 The conduit of each circuit or section shall be completed before conductors are drawn in. The entire system of conduit after erection shall be tested for Mechanical and electrical continuity throughout and permanently connected to earth. Conduit shall not be used as a earth medium. A separate earth wire of 14 SWG / 2mm copper wire shall run along with each conduit for earthing. Alternatively PVC insulated copper conductor of same size as that of the phase conductor shall run inside the conduit pipe. If conduit pipes are liable to mechanical damage, they shall be adequately protected.

4.12 Inspection Boxes

Suitable inspection boxes, fabricated out of 2 mm M.S. sheet shall be provided to permit periodical inspection and to facilitate removal of wires, if required. Every box should be provided with a suitable brass earthing screw in tapped holes to facilitate connection to earth continuity conductor.

4.13 Fixing of Conduits in Chase

4.13.1 The conduit shall be fixed by means of staples at not more than 600 mm apart. The conduits shall be embedded in brick work before plastering.

4.13.2 For installation of conduit, switch box, pull box, panel, switches wherever masonry or slab or brick wall is chipped after plastering the chipped portion shall be finished neatly in a manner acceptable to Engineer-in-charge by contractor doing electrical installation work.

4.13.3 In case of conduits to be fixed in 150 mm or less thick brick work, the conduit along with all accessories switch boxes, etc. should be fixed simultaneously along with construction of brick work. If required conduit layout shall be installed before construction of brick work with necessary supporting arrangement for the conduit layout to stay in position. Conduits to be embedded in RCC structure shall be put in

position, and securely bound to reinforcement before the concrete is poured. The contractor shall ensure that there is proper coordination and supervision to avoid displacement of such conduits.

4.13.4 Except inside false ceiling and other places indicated in drawing and schedule of quantities, at all other areas concealed conduit installation has to be executed. Maximum size of conduit allowed to be concealed in the slab will be 32 mm. Wherever bigger size of conduit is required a row of small size conduit may be used all terminating in the same box

5 Boxes For Modular Wiring Accessories :

5.1 SWITCH BOXES - MODULAR TYPE

Switch boxes suitable to house modular type switches of required ratings, and fan regulators as required shall be provided. In case the number of switches in one box is not tallying with that available in standard manufacture, the box accommodating the next higher number of switches shall be provided without any extra cost. In case fan regulator/regulators is /are to be provided at a later dated, suitable provision for accommodating such regulators shall be made in the switch boxes and blank off covers shall be provided without any extra cost.

Switch boxes shall be so designed that accessories are mounted on a grid plate with tapped holes for brass machine screws leaving ample space at the back and on the sides for accommodating conductors, check-nuts and screwed bushes at conduit entries etc... The grid plates and M.S. boxes shall be fitted with a brass earth terminal. Boxes shall be attached to conduits by means of check-nuts on either sides of their walls. Moulded front covers made from high impact resistant, flame retardant and ultra violet stabilized engineering plastics shall be fixed by means of counter sunk chromium plated brass machine screws. No timber shall be used for any supports. Switch boxes shall be located with bottom at 1200 mm above floor level unless otherwise indicated.

5.2 MODULAR TYPE BOXES FOR SOCKET OUTLETS

Outlet boxes shall be suitable for housing modular type switched socket outlets/ telephone outlets/ buzzers and any other outlet as required. These shall be so designed that accessories are mounted on a grid plate with tapped holes for brass machine screws leaving ample space at the back and on the sides for accommodating conductors, checknuts and screwed bushes at conduit entries etc. The grid plates and M.S. boxes shall be fitted with a brass earth terminal. These shall be attached to conduits by means of check nuts on either sides of their walls. Moulded front covers made from high impact resistant, flame retardant and ultra violet stabilized engineering plastics shall be used to mount the outlets and shall be fixed to the outlet M.S. boxes by means of counter sunk chromium plated brass machine screws. No timber supports shall be used. Boxes shall be located at skirting level or bottom at 1200 mm from floor or inside raceways on laboratory work tables., as indicated in drawings and/or as directed.

5.3 Construction :

5.3.1 Control at the point of commencement of supply.

5.3.1.1 The main switch shall be located near the termination of service line and it shall be easily accessible without the use of any external aid and the main switch shall be installed at a height of 1.8m from finished floor level. The exact location shall be finalised by the Engineer –in - charge.

5.3.1.2 A circuit breaker or switch fuse unit shall be provided at the point of entry. There shall not be any break in the neutral wire in the form of fuse or switch unit. The neutral shall also be marked clearly.

5.3.2 Location of the switch boards.

5.3.2.1 Switch boards shall be placed only in dry locations and in ventilated rooms and they shall not be placed in the vicinity of storage batteries or exposed to chemical fumes.

5.3.2.2 In a damp situation or where flammable or explosive dust, vapor or gas is likely to be present, the switch board shall be totally enclosed or made flame proof as may be necessitated by the particular circumstances.

5.3.2.3 Main board location shall be such that it is easily accessible for firemen and other personnel to quickly disconnect the supply in case of emergencies.

5.3.2.4 Care shall be taken not to erect switch boards above gas stoves or sinks within 2.5m of any washing unit in the washing rooms.

5.3.2.5 Main switch boards shall be installed in rooms or cupboards having provisions for locking arrangement so as to safeguard against operation by unauthorized personnel.

5.3.2.6 Adequate Illumination shall be provided for all working spaces around the switch boards when installed indoors.

5.3.2.7 In case of switch boards fixed in places likely to be exposed to weather or to abnormal moist atmosphere, the outer casing shall be weather proof and shall be provided with glands or bushing or adopted to receive screwed conduit, according to the manner in which the cables are run.

5.3.2.8 When the switch boards are recessed in wall, the front shall be fitted with a hinged panel of teakwood or other suitable material such as hylam, or with unbreakable glass doors in teak wood frame with locking arrangement, the outer surface of the doors being flush with the walls. Sufficient space shall be provided at the back for connection and at the front between switchgear mountings and the door.

5.3.2.9 Wall mounted switch boards shall be installed such that the bottom is at a minimum height of 1.20 m above finished floor level wherever applicable, as indicated in the drawing.

5.3.2.10 The various live parts, unless they are effectively screened by substantial barriers of non- hygroscopic, Non-flammable insulating material, shall be so spaced that an arc cannot maintain between such parts and earth.

5.3.2.11 No, apparatus shall project beyond any edge of the panel. No fuse body shall be mounted within 2.5cm of any edge of the panel and no holes by means of which the panel is fixed shall be drilled closer than 1.3cm from any edge of the panel.

5.3.2.12 Equipment which is on the front of a switch board shall be so arranged that inadvertent personnel contact with live parts is unlikely during the manipulation of switches, changing of fuses or similar operation.
In every case in which switches and fuses are fitted on the same pole, these fuses, shall be so arranged that the fuses are not live when their respective switches are in 'OFF' position.

5.3.2.13 No fuses other than fuses in instrument circuit shall be fixed on the back or behind a switch board panel or frame.

5.3.2.14 The arrangement of the gear shall be such that they shall be readily accessible and their connections to all instruments and apparatus easily traceable.

6 Cross Section:

The conduits shall be of ample sectional area to facilitate simultaneous drawing of wires and permit future provision also. Total cross section of wires measured overall shall not normally be more than half the area of the conduit. Maximum number of FRLS insulated 660/1100 Voltage grade copper conductor cable conforming to IS - 694 - 1990 as per table give below.

• Maximum no of FRLS insulated 660/1100 V grade copper Conductor cable conforming to IS : 694 - 1990

Normal Cross Sectional area of conductor in sq. mm	20 mm		25 mm		32 mm		38 mm		51 mm		64 mm	
	S	B	S	B	S	B	S	B	S	B	S	B
1	2	3	4	5	6	7	8	9	10	11	12	13
1.50	5	4	10	8	18	12	-	-	-	-	-	-
2.50	5	3	8	6	12	10	-	-	-	-	-	-
4	3	2	6	5	10	8	-	-	-	-	-	-
6	2	-	5	3	4	8	7	-	-	-	-	-
10	2	-	4	3	6	5	8	6	-	-	-	-
16	-	-	2	2	3	3	6	5	10	7	12	8
25					3	2	5	3	8	6	9	7
35							3	2	6	5	8	6
50									5	3	6	5
70									4	3	5	4

Note :

1. The above table shows the maximum capacity of conduits for a simultaneous drawing in of cables.
2.. The columns headed 'S' apply to runs of conduits which have distance not exceeding 4.25 m between draw boxes and which do not deflect form the straight by an angle of more than 15 degrees. The columns headed 'B' apply to runs of conduit which deflect form the straight by an angle of more than 15 degrees.
3. Conduits sizes are the nominal external diameters.

7 WIRES:

Wiring shall be carried out with FRLS insulated Fire Retardant 660/1100 volt grade unsheathed single core wires with electrolytic annealed stranded copper (unless otherwise stated) conductors and conforming to IS 694/1990. All wire rolls shall be ISI marked. All wires shall bear manufacturer's label and shall be brought to site in new and original packages. Manufacturer's certificate, certifying that wires brought to site are of their manufacture shall be furnished as required.

8 LAYING OF CONDUITS:

a) Conduits shall be laid either recessed in walls and ceilings or on surface on walls and ceilings or partly recessed and partly on surface, as required.
b) Same rate shall apply for recessed and surface conduiting in this contract.
c) Stranded copper conductor insulated wire of size as per schedule of quantities shall be provided in entire conduiting for loop earthing.
d) GI wire of suitable size to serve as a fish wire shall be left in all conduit runs to facilitate drawing of wires after completion of conduiting.

8.1 Recessed Conduiting

Conduits recessed in concrete members shall be laid before casting, in the upper portion of slabs or otherwise as may be instructed, so as to embedd the entire run of conduits and ceiling outlet boxes with a cover of minimum 12 mm concrete. Conduits shall be adequately tied to the reinforcement to prevent displacement during casting at intervals of maximum 1 meter. No reinforcement bars shall be cut to fix the conduits. Suitable flexible joints shall be provided at all locations where conduits cross expansion joints in the building.

Conduits recessed in brick work shall be laid in chases to be cut by electrical Contractor in brick work before plastering. **The chases shall be cut by a chase cutting electric machine.** The chases shall be of sufficient width to accommodate the required number of conduits and of sufficient depth to permit full thickness of plaster over conduits. The conduits shall be secured in the chase by means of heavy duty pressed steel clamps screwed to MS flat strip saddles at intervals of maximum 1 meter. The chases shall then be filled with cement and coarse sand mortar (1:3) and properly cured by watering.

Entire recessed conduit work in concrete members and in brick work shall be carried out in close coordination with progress of civil works. Conduits in concrete members shall be laid before casting and conduits in brick work shall be laid before plastering. Should it become necessary to embed conduits in already cast concrete members, suitable chase shall be cut in concrete for the purpose. For minimising this cutting, conduits of lesser diameter than 25 mm and outlet boxes of lesser depth than 50 mm could be used by the Contractor for such extensions only after obtaining specific approval from Project Managers. For embedding conduits in finished and plastered brick work, the chase would have to be made in the finished brick work. After fixing conduit in chases, chases shall be made good in most workmanlike manner to match with the original finish.

Cutting chases in finished concrete or finished plastered brick work fo recessing conduits and outlet boxes etc shall be done by the Contractors without any extra cost.

8.2 Surface Conduiting:

Wherever so desired, conduit shall be laid in surface over finished concrete and/or plastered brickwork. Suitable spacer saddles of approved make and finish shall be fixed to the finished structural surface along the conduit route at intervals not exceeding 600 mm. Holes in concrete or brick work for fixing the saddles shall be made neatly by electric drills using masonry drill bits. Conduits shall be fixed on the saddles by means of good quality heavy duty MS clamps screwed to the saddles by counter sunk screws. Neat appearance and good workmanship of surface conduiting work is of particular importance. The entire conduit work shall be in absolute line and plumb.

8.3 Fixing of conduit fittings and accessories :

For concealed conduiting work, the fittings and accessories shall be completely embedded in walls/ceilings leaving top surface flush with finished wall/ceiling surface in a workman like manner.

Loop earthing wire shall be connected to a screwed earthstead inside outlet boxes to make an effective contact with the metal body.

8.4 Protection of Conduits:

To safeguard against filling up with mortar/plaster etc. all the outlet and switch boxes shall be provided with temporary covers and plugs which shall be replaced by sheet/plate covers as required. All screwed and socketed joints shall be made fully water tight with white lead paste.

8.5 Cleaning of Conduit Runs:

The entire conduit system including outlets and boxes shall be thoroughly cleaned after completion of erection and before drawing in of cables.

8.6 Protection Against Dampness:

All outlets in conduit system shall be properly drain and ventilated to minimize chances of condensation/sweating.

8.7 Expansion Joints:

When crossing through expansion joints in buildings, the conduit sections across the joint shall be through approved quality heavy duty metal flexible conduits of the same size as the rigid conduit.

8.8 Loop Earthing:
Loop earthing shall be provided by means of insulated stranded copper conductor wires of sizes as per Schedule of Quantity laid along with wiring inside conduits for all wiring outlets and sub-mains. Earthing terminals shall be provided inside all switch boxes, outlet boxes and draw boxes etc.

9 LAYING AND DRAWING OF WIRES:

9.1 Bunching of Wires:
Wires carrying current shall be so bunched in conduits that the outgoing and return wires are drawn into the same conduit. Wires originating from two different phases shall not be run in the same conduit.

9.2 Drawing of Wires:
The drawing of wires shall be done with due regard to the following precautions:-

No wire shall be drawn into any conduit, until all work of any nature, that may cause injury to wire is completed. Burrs in cut conduits shall be smoothen before erection of conduits. Care shall be taken in pulling the wires so that no damage occurs to the insulation of the wire. Approved type bushes shall be provided at conduit terminations.

Before the wires are drawn into the conduits, conduits shall be thoroughly cleaned of moisture, dust, dirt or any other obstruction by forcing compressed air through the conduits if necessary. While drawing insulated wires into the conduits, care shall be taken to avoid scratches and kinks which cause breakage of conductors. There shall be no sharp bends.

The Contractor shall, after wiring is completed, provide a blank metal/sunmica plateon all switch / outlet / junction boxes for security and to ensure that wires are not stolen till switches / outlets etc.. are fixed at no extra cost the contractor shall be responsible to ensure that wires and loop earthing conductors are not broken and stolen. In the event of the wire been partly / fully stolen, the contractor shall replace the entire wiring along with loop earthing at no extra cost to the Client. No joint of any nature whatsoever shall be permitted in wiring and loop earthing .

9.3 Termination /Jointing of Wires
Sub-circuit wiring shall be carried out in looping system. Joints shall be made only at distribution board terminals, switches/buzzers and at ceiling roses/connectors/lamp holders terminals for lights/fans/socket outlets. No joints shall be made inside conduits or junction/draw/inspection boxes.

Switches controlling lights, fans or socket outlets shall be connected in the phase wire of the final sub circuit only. Switches shall never be connected in the neutral wire.

Wiring conductors shall be continuous from outlet to outlet. Joints where unavoidable, due to any special reason shall be made by approved connectors. Specific prior permission from Project Manager in writing shall be obtained before making such joint.

Insulation shall be shaved off for a length of 15 mm at the end of wire like sharpening of a pencil and it shall not be removed by cutting it square or wringing. Strands of wires shall not be cut for connecting terminals. All strands of wires shall be twisted round at the end before connection.

Conductors having nominal cross sectional area exceeding 4 sq. mm shall always be provided with crimping sockets. At all bolted terminals, brass flat washer of large area and approved steel spring washers shall be used. Brass nuts and bolts shall be used for all connections. The pressure applied to tighten terminal screws

shall be just adequate, neither too much nor too less. Switches controlling lights, fans, socket outlets etc. shall be connected to the phase wire of circuits only. Only certified valid license holder wiremen shall be employed to do wiring / jointing work.

9.4 Load Balancing
Balancing of circuits in three phase installation shall be planned before the commencement of wiring and shall be strictly adhered to.

9.5 Color Code of Conductors
Color code shall be maintained for the entire wiring installation - red, yellow, blue for three phases, black for neutral and green for earth.

10 MCBs/ MCB DISTRIBUTION BOARDS:

10.1 Miniature Circuit Breakers
- The MCB's shall be of the completely moulded design suitable for operation at 240/415 Volts 50 Hz system.

- The MCB's shall have a rupturing capacity of 10 KA at 0.5 p.f.

- The MCB's shall have inverse time delayed thermal overload and instantaneous magnetic short circuit protection. The MCB time current characteristic shall coordinate with FRLS cable characteristic.

10.2 MCB Distribution Boards
- All the distribution boards shall be with MCBs as described in the respective schedule.

- All MCB DBs shall be factory made

- Each outgoing circuit shall be provided either with MCB.

- The neutral shall be connected to a common link and be capable of being disconnected individually for testing purposes.
- The distribution board shall comply with the specifications as given in Schedule and covered with Poly propylene front cover and supplied by the Standard Companies as given in the Recommended Makes.

- The distribution board shall be fixed at 1.5m from F F L or as specified in Drawing and shall be installed in flush with wall/ niche as indicated in Drawing

- They shall be weather proof if exposed to weather or damp situations.

- The following shall be marked on the distribution boards :
  a) Danger 415 volts.
  b) Accessible only to authorized persons Shall be provided with circuits list giving details of each circuit which it controls along with circuit rating and MCB size
  c) The panel from where power is tapped to D.B.
  d) All marking shall be clear and legible.

1. The total load of the consuming devices shall be evenly distributed between the number of ways of distribution board and the Details of Circuits indicated shall be followed.

2. The consuming devices circuit shall be connected to distribution board in proper sequence, so as to avoid unnecessary crossing of wires.

3. Cables shall be connected to a terminal only by soldered or crimped lugs.

4. Cables shall be rigidly fixed in such a manner that a clearance of at least 2.5cm is maintained between conductors of opposite polarity or phase and between the conductors and any material other than insulating material.

5. The incoming and outgoing cables shall be neatly bunched.

11 MEASUREMENT AND PAYMENT OF WIRING:

Wiring for lights, fans, convenience socket outlets and telephone outlets etc. shall be measured and paid for on POINT BASIS as itemized schedule of quantities and as elaborated as below unless otherwise stated.

Primary and Secondary light point wiring

In respect of group control of lights (more than one light controlled by one switch or MCB), wiring upto the first light in the group shall be measured and paid for as a primary light point. Wiring for other lights looped in one group for switch controlled as also MCB controlled lights shall be measured and paid for as secondary light points. Primary light points for switch controlled lights shall include the cost of control switch whereas primary light points controlled by MCBs shall not include the switch cost. The cost of MCB controlling such lights shall not be included in the primary light point rate since the MCB shall be paid for in the item of DB.

The point wiring basis shall assume average wiring length and average conduit length per point based on parameters. The average wiring length and average conducting length forming the basis of point wiring payment, shall take the electrical layouts of the entire project into consideration. Tenderers are advised to seek clarifications, if they so desire, on this aspect before submitting their tenders. No claim for extra payment on account of electrical layouts in part or whole of the project requiring larger average wiring and conduit length per point, whether specifically shown in tender drawings or not, shall be entertained after the award of contract.

12 ROUTINE AND COMPLETION TESTS:

12.1 Installation Completion Tests

At the completion of the work, the entire installation shall be subject to the following tests:

1. Wiring continuity test
2. Insulation resistance test
3. Earth continuity test
4. Earth resistivity test

Besides the above, any other test specified by the local authority shall also be carried out. All tested and calibrated instruments for testing, labour, materials and incidentals necessary to conduct the above tests shall be provided by the contractor at his own cost.

12.2 Wiring Continuity Test

All wiring systems shall be tested for continuity of circuits, short circuits, and earthing after wiring is completed and before installation is energized.

12.3 Insulation Resistance Test

The insulation resistance shall be measured between earth and the whole system conductors, or any section thereof with all fuses in place and all switches closed and except in concentric wiring all lamps in position of both poles of the installation otherwise electrically connected together, a direct current pressure of not less than twice the working pressure provided that it does not exceed 1100 volts for medium voltage circuits. Where the supply is derived from AC three phase system, the neutral pole of which is connected to earth, either direct or through added resistance, pressure shall be deemed to be that which is maintained between the phase

conductor and the neutral. The insulation resistance measured as above shall not be less than 50 megohms divided by the number of points provided on the circuit the whole installation shall not have an insulation resistance lower than one megohm.

The insulation resistance shall also be measured between all conductors connected to one phase conductor of the supply and shall be carried out after removing all metallic connections between he two poles of the installation and in those circumstances the insulation shall not be less than that specified above.

The insulation resistance between the frame work of housing of power appliances and all live parts of each appliance shall not be less than that specified in the relevant Standard specification or where there is no such specification, shall not be less than half a megohm or when PVC insulated cables are used for wiring 12.5 megohms divided by the number of outlets. Where a whole installation is being tested a lower value than that given by the above formula subject to a minimum of 1 Megohms is acceptable.

12.4 Testing Of Earth Continuity Path

The earth continuity conductor including metal conduits and metallic envelopes of cable in all cases shall be tested for electric continuity and the electrical resistance of the same along with the earthing lead but excluding any added resistance of earth leakage circuit breaker measured from the connection with the earth electrode to any point in the earth continuity conductor in the completed installation shall not exceed one ohm.

12.5 Testing Of Polarity Of Non-Linked Single Pole Switches

In a two wire installation a test shall be made to verify that all non-linked single pole switches have been connected to the same conductor throughout, and such conductor shall be labeled or marked for connection to an outer or phase conductor or to the non-earthed conductor of the supply. In the three of four wire installation, a test shall be made to verify that every non-linked single pole switch is fitted to one of the outer or phase conductor of the supply. The entire electrical installation shall be subject to the final acceptance of the Development Manager as well as the local authorities.

12.6 Earth Resistivity Test

Earth resistivity test shall be carried out in accordance with IS Code of Practice for earthing IS 3043.

12.7 Performance

Should the above tests not comply with the limits and requirements as above the contractor shall rectify the faults until the required results are obtained. The contractor shall be responsible for providing the necessary instruments and subsidiary earths for carrying out the tests. The above tests are to be carried out by the contractor without any extra charge.

12.8 Tests And Test Reports

The Contractor shall furnish test reports and preliminary drawings for the equipment to the Project Managers/consultants for approval before commencing supply of the equipment. The Contractor should intimate with the tender the equipment intended to be supplied with its technical particulars. Any test certificates etc., required by the local Inspectors or any other Authorities would be supplied by the Contractor without any extra charge.

13 Occupancy Sensors:

The Occupancy Sensor shall be provided in the closed Cabin, Common Areas to switch ON fluorescent / LED/ CFL /Incandescent fixtures through ultra sonic/ infrared sensing technology or combination of both. The time delay to switch OFF in case of non-occupancy shall be available.

The unit shall be mounted in recess with false ceiling. The broad specifications are given below.

Supply Voltage	: 200-260V AC, 50Hz
Load current	: 10A, Fluorescent / CFL

Minimum Current	: 0A
Detection Method	: Ultrasonic/ Infra-red/ Combination (any one)
Status Indication	: Red LED
Mounting	: 3Mtr above FFL, Recessed
Field of view	: 3600
Warm up Time	: 5Sec

Operating temperature range: 00 C to 500 C

Operating Humidity	: 10 - 95% RH

Detection field on work table: 6Mtr

Time setting	: 5Minutes fixed or variable in steps of 5Minutes each

COAXIAL CABLES

The coaxial cables shall be of vide band type with operation up to 300 MHz capability. Aging resistance shall comply with DIM 472.52 part 2 e.i. Maximum 5% increase in attenuation at 200 MHz measured by artificial aging (14 days at 80o C) cables shall meet all exceed following specifications

Center core Dia	0.8 mm
Dielectric Dia	4.8 mm
Dielectric	PE
Outer Conductor Dia	5.4 mm
Outer Dia	7.0 mm
Bending radius	more than 30 mm
Impedance	75 ohms
D.C Resistance	50 ohms/KM
Screening factor	more than 50
Attenuation	
50 Mhz	6.5
100 Mhz	9
200 Mhz	13
300 Mhz	16

Earthing

1. SCOPE:

This specification is intended to cover the requirements of supply, installation, testing and commissioning of

a) Pipe earthing b) Plate earthing c) Strip earthing

2. STANDARDS:

Earthing installations shall conform to the Indian Electricity Rules - 1956, as amended from time to time and IS 3043-1989 "code of practice for earthing", with latest amendments.

3. Earth electrode arrangement :

3.1 Pipe electrode :

3.1.1 Electrode shall be made of GI pipe having a clean surface and not covered with paint, enamel or poorly conducting material. Galvanized pipe shall not be smaller than 40 mm ID. Earthing with pipe electrode shall be done as per the details indicated in IS : 3043/87 .

3.1.2 Electrodes shall be embedded below permanent moisture level.

3.1.3 The length of pipe electrodes shall not be less than 2.5 m. if rock is encountered, pipes shall be driven to a depth of not less than 2.5 m with suitable inclination. Pipe shall be in one piece and deeply driven.

3.1.4 To reduce the depth of burial of an electrode without increasing the resistance, a number of rods or pipes may have to be connected together in parallel. The distance between two electrodes in such a case shall not be less than twice the length of the electrode. The earthing lead shall be connected by means of a through bolt, nuts and washers and cable socket.

3.2 Plate electrode :

For plate electrodes, minimum dimensions of the electrode shall be as under.
3.2.1 GI plate electrode : 600 x 600 x 6 mm thick.
3.2.2 Copper plate electrode : 600 x 600 x 3.15 mm thick
3.2.3 The electrode shall be buried in ground, with its faces vertical and top not less than 2.5 M from the surface of the ground.

3.2.4 Earthing using plate electrode shall be done as per details, indicated in drawing.

3.2.5 Plate electrodes shall be fastened to sch B GI Pipe, buried vertically . One end of pipe shall be at least 5 cm above the surface of the ground and need not be more than 10 cm. The internal diameter of the pipe shall be at least 40 mm. The length of pipe under the earth's surface shall be such that it shall be able to reach the center of the plate. The GI earth strip lead shall be securely bolted the plate with two bolts, nuts, check nuts and washers as in the drawing.

3.3. Strip or conductor electrodes :

3.3.1. Strip electrode shall not be smaller than 25 x 1.6 mm, if of copper and 25 x 3 mm, if of galvanized iron and steel. If round conductors are used as earth electrodes, their cross sectional area shall not be smaller than 3 sq.mm , if of copper and 6 sq.mm , if galvanized iron and steel.
3.3.2. Conductor shall be buried in trenches not less than 0.5 m deep.

4.0 General :

i) All materials used for connecting the earth lead with electrode shall be of GI in case of GI pipe and GI plate electrodes, and of tinned brass in case of copper plate electrode. The earthing lead shall be securely connected at the other end to the main board.
ii) The earthing lead from electrode onwards shall be suitably protected against mechanical injury by routing the earth wire / strip through a suitable size of GI pipe.
iii) All medium voltage equipments shall be earthed by two separate and distinct connections with the earth. In the case of high and extra high voltages, the neutral points shall be earthed by not less than two separate and distinct connections with the earth, each having its own electrode at the generating station or substation.
iv) All materials, fittings etc. used in earthing shall conform to Indian standard specifications wherever they exist. In the case of materials for which Indian standard specifications do not exist, such materials shall be approved by the Engineer-in-Charge.
v) The earth electrode shall be kept free from paint, enamel and grease.
vi) It shall be ensured that similar materials for respective earth electrodes and earth conductors are used.
vii) Earth electrode shall not be installed in proximity to a metal fence.
viii) Copper/GI strip shall be connected to the respective earth electrodes, either by brazing or welding respectively. The Copper/GI strip shall be jointed only either by brazing or by riveting at the end of over lapping portions. The overlap shall not be less than 50 mm.
ix) Earthing clamps used for supporting earth strips shall be made of such materials so as to avoid bimetallic action between strip and clamps.

5. Testing:

The earth resistance of each electrode shall be measured by using a reliable and calibrated earth Meggar and the value shall be as per IS/IE rules.

6. Equipotential Bonding:

As per NEC, Equipotential Bonding is defined as Electrical connection intended to bring exposed conductive parts or extraneous conductive parts to the same or approximately the same potential.

Exposed conductive parts of equipment being part of the electrical installation used in the same room shall be connected to a common protective conductor.

A main equipotential bonding with a main earthing bar shall be provided near the main service entrance. Connections shall be made to the following parts by bonding conductors:

a) lightning-conductor;
b) earthing systems of the electric power distribution system;
c) the central heating system;
d) the conductive water supply line;
e) the conductive parts of the waste water line;
f) the conductive parts of the gas supply; and
g) the structural metal framework of the building,
if applicable.

Main equipotential bonding conductors shall have cross-sectional areas not less than half the cross-sectional area of the largest protective conductor of the installation, subject to a minimum of 6 mm2. The cross-sectional area need not, however, exceed 25 mm2, if the bonding conductor is of copper or a cross-sectional area affording equivalent current-carrying capacity in other metals.

Connections shall be provided from the equipotential bonding bar to extraneous conductive parts, such as pipes for fresh water, heating, gases, vacuum and other parts with a conductive surface area larger than 0.02 m2 or a linear dimension exceeding 20 cm, or smaller parts that may be grasped by hand.

Additionally the following requirements apply:

A) Such connections need not be made to:

i) Extraneous conductive parts inside of walls (for example structural metal frame work of buildings) having no direct connection to any accessible conductive part inside the room

ii) conductive parts in a non-conductive enclosure.

B) In locations where the position of the patient can be predetermined this provision may be restricted to extraneous conductive parts within the patient environment

i) In operating theaters, intensive care rooms, heart catheterization rooms & rooms intended for the recording of bioelectrical action potentials all parts should be connected to the equipotential bonding bar via direct and separate conductors.

The details of street light as per specifications & shop drawings to be furnished by vendor for approval by Project Manager & Architect before prodrements.

RECOMMENDED MAKES OF MATERIALS

1. Selector Switches	: Salzar/ Kaycee
2. MCBs / DB's	: Legrand/Schneider/ABB
3 Switches/Sockets	: Legrand- Lyncus, Mylinc, MK India (Logic)
4. FRLS Copper Conductor wires	: Finolex/La

PART C:TECHNICAL SPECIFICATION FOR AIR CONDITIONING & MECHANICAL VENTILATION SYSTEM

1.1 SPECIAL CONDITIONS

1.1.1 General

Vendor to furnish shop drawing for approval upon issue of Work Order.

Any clarification / interpretation shall be clarified well in advance without delaying any item of execution.

Any substitution item will have to be approved in writing by Client / Architect / Consultant well in advance.

1.1.2 Unloading at site

Shifting of material to the point of installation including lifting using mechanical means to the designated floor.

Note: 1. Vendor to study the methodology to lift all the Equipment's and position at respective places as per drawing etc., at appropriate levels and only Project Manager at site approved methodology to be adopted.

Note: 2. Necessary permissions from authorities to be taken by the contractor before lifting all equipment's.

Insurance for the workmen, material and third-party liability to be taken care by the HVAC contractor.

Coordination with client / client's maintenance person etc., for interconnecting of chilled water pipes to Process cooling Equipment etc., commissioning of Process cooling Equipment, power termination, testing etc., to be taken care by the HVAC contractor.

Note: 3: HVAC works contractor shall depute his qualified engineer during installation, while commissioning, testing and handing over.

Any items and works not specifically mentioned above but as required for the works should brought to the Client / Architect / Consultant well in advance. (Contractor to specify the nature of work / item)

2.0 Section – 2 – Technical Specification

2.1 TECH SPEC-1- CODES AND STANDARDS

2.1.1 CODES AND STANDARDS

Codes, Regulations and Standards

The installation shall conform in all respects to as per PROJECT MANAGERS / Indian Standard Code of Practice for Air conditioning Installation, tender specifications, and drawings.

In case of discrepancy among specifications, drawings and other documents, the specifications take precedence over all other documents. In case of discrepancy between specification, drawings etc AND Codes & Standards, the tenderer shall assume the more stringent of the two.

Air Conditioning Equipment	
IS 659	Safety Code for air conditioning
IS 660	Safety Code for mechanical refrigeration
IS 3615	Glossary of terms used in refrigeration & air conditioning
IS 5111	Testing of refrigeration compressors
IS 7896	Data for outside design conditions for air conditioning
IS 10617	Hermetic Compressors (Part-I, II & III)
IS 11338	Thermostats for use in refrigeration, air conditioners etc.
SP 7	National Building Code (Group 4)
IS 3615	Glossary of terms used in refrigeration and air conditioning
IS 7896	Data for outside design conditions for air conditioning for summer months
Noise & Vibration	
IS 2264	Preferred frequencies for acoustical measurements.
IS 3483	Code of practice for noise reduction
IS 3932	Sound level meter for general purpose use.
IS 9736	Glossary of terms applicable to acoustics in buildings.

IS 9901	Measurement of sound insulation in buildings & building elements
IS 9876	Guide to the measurement of air borne acoustical noise & evaluation of its effects on man.
IS 10423	Personal sound exposure meter.
IS 11446	Measurement of air borne noise emitted by compressors units intended for outdoor use.
IS 12710	Glossary of terms used in acoustic emission testing.
IS 4758	Methods of measurement of noise emitted by machines
IS 14280	Mechanical vibration – balancing – shaft and fitment key convention
IS 12065	Permissible limits of noise level for rotating electrical machines.
Refrigerant Gas & Lubricants	
IS 1447	Method of sampling and test for lubricants.
IS 4578	Lubricating oils for refrigeration machinery
IS 10609	Refrigerants – Number – Designation

TECH SPEC -2 - EQUIPMENT SPECIFICTIONS FOR DX. VRV/VRF AIR-CONDITIONERS

2.2.1 AIR COOLED DIRECT EXPANSION VARIABLE REFRIGERANT VOLUME / FLOW (VRV/VRF) SYSTEM

2.2.2 GENERAL

2.2.3 SCOPE OF HVAC SYSTEM:

The scope of this section comprises the supply, installation, testing and commissioning of Variable Refrigerant Flow System & ventilation system conforming to the specifications and in accordance with the requirements of Drawings and Schedule of quantities. A Zonal air conditioning system shall be designed to provide year-round thermal environmental control for all air-conditioned areas.
The system selected is a floor wise / Cluster wise modular system, with number of indoor units connected to centrally locate outdoor units, as per detail design given in the tender. The outdoor units shall be air cooled type and mounted on terrace of the building. Indoor units in various areas shall be as per enclosed drawings/ Bill of Quantities.

All the VRF / VRV air conditioners shall be fully factory assembled, wired, internally piped & tested.

The outdoor unit shall be pre-charged with first charge of R 410A Refrigerant. Additional charge shall be added as per refrigerant piping at site. All the units shall be suitable for operation with 415 V +/- 10%, 50 Hz +/- 5%, 3 Phase supply for outdoor units & 230 V +/- 10%, 50 Hz +/- 5%, Single Phase supply for indoor units. Only one cable will be extended to each Outdoor unit and if any additional breakup of supply is required, the Contractor shall provide suitable outdoor distribution box as part of Unit cost.

The VRF / VRV system shall provide stable, trouble free & safe operation, with flexibility of Operating desired indoor units. The outdoor units must be capable of delivering exact Capacity proportional to the number of indoor units switched on & the heat load in the air-conditioned area. The proportional operation shall be achieved by varying Speed of the compressor in the outdoor units.

The operation of the VRF / VRV system shall be through independent wired/ wireless remote controllers as specified.

2.2.4 TYPE:

Unit shall be a VRF or VRV system inverter driven heat pump air conditioner for application with R410 A refrigerant air cooled, variable refrigerant flow / Volume air conditioner consisting of one outdoor unit and multiple indoor units. Each indoor unit shall have suitable capacity to cool independently for the requirement of the respective spaces.

It shall be possible to connect multiple indoor units on respective refrigerant circuits as shown in the drawings/BOQ. The indoor units can be of different type and also controlled individually. Following type of indoor units is envisaged to be connected to the system:

- Ceiling mounted cassette type (2- and 4-Way flow).
- Ceiling mounted ductable type.
- Wall mounted Hi-Wall type.
- Floor mounted type.
- Treated Fresh Air Unit (Ceiling mounted ductable unit)

Compressor installed in outdoor unit shall be equipped with inverter controller, and capable of changing the rotating speed to follow variations in cooling. Outdoor unit shall be suitable for mix-match connection of all type of indoor units.

The refrigerant piping between indoor units and outdoor units shall be extended up to 150m with maximum 50 m level difference. Oil recovery system shall be designed to operate without disturbance to normal operation cycle of the system / compressor.

Both indoor unit and outdoor unit shall be factory assembled, tested and filled with first charge of refrigerant before delivery at site.

2.2.5 OUTDOOR UNIT

The outdoor unit shall be factory assembled; weatherproof casing constructed from heavy gauge galvanized steel sheet with powder coated finish. Outdoors units of the VRV system shall be compact air-cooled type.
All outdoor units above 12 HP rating shall have multiple number of scroll compressors, The compressors of the outdoor units must be hermetically sealed scroll type. Each module of outdoor unit must have separate inverter operated compressor, suitable to operate at heat load proportional to indoor requirement.
Each refrigeration cycle shall be equipped with scroll compressors, solenoid valve, heat exchanger, an accumulator, 4-way valve and flare connection parts

In case of outdoor units with multiple compressors, the operation shall not be disrupted with failure of any compressor.
The outdoor units must be suitable for up to min. 150 m refrigerant piping between outdoor unit & the farthest indoor units, with total piping length of 300 m for all the indoor units. Allowable level difference between outdoor unit & indoor units shall be min. 50 m in case of outdoor unit on top & min.40 m in case of outdoor unit at bottom. Allowable Level difference between various indoor units connected to one outdoor unit shall be up to min. 15 m.
The noise level shall not be more than 60 dB (A) at normal operation measured horizontally 1m away and 1.5 m above ground level.

The unit shall be provided with microprocessor control panel.

The outdoor fans shall be plastic propeller type, dynamically balanced. The fan shall be directly driven by a suitable motor for vertical flow discharge. The fan motor shall be permanently lubricated and be protected from ingress of water.

The compressor shall be protected against breakdown by a quick response over current relay, a high-pressure switch, a wraparound type of oil heater and discharge gas thermistor.

The outdoor unit shall employ system of equal run time for all the compressors, Inverter or on/ off type, within each outdoor unit – Single Module or Multi Module.
The outdoor units shall be suitable to operate within an ambient temperature range of – 5 Deg C to 45 Deg C, in cooling mode.
Air cooled condenser shall have Axial Flow, upward throw fan, directly coupled to fan motors with minim um IP 55 protection. The outdoor unit condenser fan shall be able to develop external static pressure up to 6 mm of water.
The entire operation of outdoor units shall be through independent remotes of indoor Units and a Common Floor wise Central controller. No separate Start/ Stop function is required.
Starter for the Outdoor Unit compressor shall be “Direct online” type. Inverter Compressor of the unit shall start first & at the minimum frequency, to reduce the inrush current during starting.

2.2.6 LOW NOISE MODE AT NIGHT:

The outdoor unit of variable refrigerant flow system has a peculiar function of night shift setting, which reduces the noise level by 5 Db at night when operating at full capacity compared with the normal operation in daytime.

2.2.7 COMPRESSOR:

The compressor shall be high efficiency, high COP scroll type and capable for capacity controlling. It shall change the speed / refrigerant mass flow rate in accordance to the variation in cooling load requirement.

Oil heater shall be provided in the compressor casing.

The inverter compressor used should be DC inverter only and shall be IGBT (insulated gate bipolar transistor) type for efficient and quiet operation.

All outdoor units shall have multiple steps of capacity control to meet load fluctuation and indoor unit individual control. All parts of compressor shall be sufficiently lubricated. Forced lubrication may also be employed.

2.2.8 OUTDOOR HEAT EXCHANGER:

The Heat Exchanger shall be constructed with copper tubes mechanically bonded to aluminium fins to form a cross fan coil and larger surface area.

The fins shall have anticorrosion treatment for Heat Exchanger Coil. The treatment shall be suitable for areas of high pollution, moisture and salt laden air.

drop. Each fan shall have a safety guard.

2.2.9 REFRIGERANT CIRCUIT:

The Refrigerant Circuit shall include a liquid receiver /accumulator, liquid & gas shut off valves and a solenoid valve. All necessary safety devices shall be provided to ensure the safety operation of the system.

2.2.10 SAFETY DEVICES:

All necessary safety devices shall be provided to ensure safe operation of the system.

Following safety devices shall be part of the outdoor unit high pressure switch, low pressure switch, fuse, crankcase heater, fusible plug, over current protection for inverter, and short recycling guard timer.

2.2.11 PIPING:

All connections of Refrigerant piping shall be in high grade Copper of Refrigeration quality and material test Certificates.

All connections, tees, reducers etc. shall be standard make fittings.

Insulation of cold lines shall be carried out with Arm flex / K-Flex / equiv. insulation sheets and tubes of appropriate thickness so that condensation does not occur. Necessary external coating protection shall be given for the complete refrigerant piping.

For individual Piping 50 / 100 mm wide Aluminium Tape shall be used at joints of Piping with Bands for identification.

2.2.12 OIL RECOVERY SYSTEM:

Unit shall be equipped with an oil recovery system to ensure stable operation with long refrigerant piping.

System shall be designed for proper oil return to compressor along with the distribution of oil to individual compressor.

The refrigerant piping shall be extended upped 150 Mtr with 50 Mtr level differences.

2.2.13 INDOOR UNITS:

Indoor unit shall be either ceiling mounted cassette type, or ceiling mounted ductable type or floor standing type or wall mounted type or other as specified in BOQ. Each unit shall have electronic control valve to control refrigerant flow rate respond to load variations of the rooms. The indoor units shall have following features:

a. The address of the indoor unit shall be set automatically in case of individual and group control.

b. In case of centralized control, it shall be set by liquid crystal remote controller.

c. The fan shall be dual suction, aerodynamically designed turbo, multi blade type, statically & dynamically balanced to ensure low noise and vibration free operation of the system. The fan shall be direct driven type, mounted directly on motor shaft having supported from housing.

d. The cooling coil shall be made out of seamless copper tubes and have continues aluminium fins. The fins shall be spaced by collars forming an integral part. The tubes shall be staggered in the direction of airflow. The tubes shall be hydraulically/ mechanically

expended for minimum thermal contact resistance with fins. Each coil shall be factory tested at 21kg/sq.mt air pressure under water.
e. Unit shall have cleanable type filter fixed to an integrally moulded plastic frame. The filter shall slide away type and neatly inserted.
f. Each indoor unit shall have computerized PID control for maintaining design room temperature. Each unit shall be provided with microprocessor thermostat for cooling and heating.
g. Each unit shall be with wired LCD type remote controller. The remote controller shall memorize the latest malfunction code for easy maintenance. The controller shall have self-diagnostic features for easy and quick maintenance and service. The controller shall be able to change fan speed and angle of swing flap individually as per requirement.
The indoor units shall generally be of following type:

Ceiling Mounted Ductable Type Unit

Each Indoor unit shall be ceiling mounted ducted type, as specified in scope of work. It shall have electronic control valve to control refrigerant flow rate in response to load variations of the room. The fan shall be of the dual suction multi blade type and statically and dynamically balanced to ensure low noise and vibration free operation. The unit shall have high static fan for Ductable arrangement.

Ceiling Mounted Cassette Type Unit (Multi Flow/ Round Flow Type)

The unit shall be ceiling mounted type. The unit shall include pre-filter, fan section and DX-coil section. The housing of the unit shall be powder coated galvanized steel. The body shall be light in weight and shall be able to suspend from four corners. The fan shall be aerodynamically designed diffuser turbo fan type. Noise level should not be more than 35 dB at low speed.
Unit shall have an external attractive panel for supply and return air. Unit shall have four way supply air grilles on sides and return air grille in canter. Each unit shall have high lift drain pump, fresh air intake provision (if specified) Low gas detection system and very low operating sound. All the indoor units regardless of their difference in capacity should have same decorative panel size for harmonious aesthetic point of view. It should have provision of connecting branch ducts.

Ceiling Suspended Type

Unit shall be suitable for ceiling suspended arrangement below false ceiling. The units include pre filter, fan section & DX-coil section. The housing of unit shall be light weight powder coated galvanized steel.

High Wall Mounted Units

The unit shall be wall mounted type. The unit includes pre filter, fan section & DX-coil section. The housing of unit shall be light weight powder coated galvanized steel. Unit shall have an attractive external casing for supply and return air.

2.2.14 REFRIGERANT PIPING

i. General Conditions

The scope of this section covers supply, laying, testing and commissioning of copper refrigerant piping. The tender drawings enclosed depict the schematic layout for the refrigerant piping routing. The contractor shall prepare his working drawings for approval by the consultant before execution at site.

The vendor shall design the piping and prepare working drawings showing full details of piping arrangement, pipe sizes and thickness, methods of supporting pipes and connections in various components for approval of Engineer-in-Charge. Work shall commence only after approval. Piping shall be able to withstand the thermal stresses and vibrations encountered during normal operations.

Refrigerant pipe sizes indicated in the tender is only tentative and the contractor shall confirm the same. Refrigerant piping shall be designed as per the requirement of the system. Suction risers shall be designed as per the minimum load requirement of the system. The contractor shall submit the design calculations for the same for the consultant's approval and then execute the same at site.

ii. Construction

Hard drawn copper pipes shall be used for the refrigerant piping.

Fittings like bends, tees, and sockets shall be of copper or brass and shall be suitable for duty involved. Flare type compression fittings shall be allowed up to 15mm size for which annealed copper tubing is used. Tubes up to and including 15mm size may be bent to form 90deg. bends with inside radius not less than 3 tube diameters. For bigger sizes, bend fittings as mentioned above shall be used. Valves shall be of packed, back seating type, and shall be forged or cast brass construction.

Joints between pipes or pipes and fittings shall be of the socketed or flanged type. Brazing alloy of the silver-copper-Phosphorous type shall be used and joints shall be made by the flow of brazing alloy by capillary action along the annular space between the two mating surfaces. Ends of mating tubes shall be square cut and cleaned properly to remove burrs and dirt or oxide. For flare type fittings, tubes shall be fully annealed at the flare before and after flaring.

iii. Piping Insulation

Refrigerant Pipe insulation thickness should be maintained as per the AC Unit manufacturers standards, different sizes for Suction & discharge pipelines such that the AC Unit cooling /efficiency should be in line with the design conditions.
Pipe Insulation minimum of 19 mm thick Fire Retardant (Class O) Nitrile Rubber/ cross linked closed cell polyethylene tube insulation shall be used for suction line and liquid line (Depends on expansion valve). Insulation shall have Fire retardant ultra violet barrier film for physical protection and for protection from sunlight. All joints shall be sealed with self-adhesive tape or with heat.

An air gap of 25 mm shall be present between adjacent insulation surfaces carrying chilled water or refrigerant. Before applying insulation, all pipes shall be brushed and cleaned. All Pipe surfaces shall be free from dirt, dust, mortar, grease, oil, etc. Thermal insulation shall be applied as follows or as specified in drawings or schedule of quantity:

Application

1. Insulating material in tube form shall be sleeved on the pipes.

2. On existing piping, slit opened tube of the insulating material (slit with a very sharp knife in a straight line) shall be placed over the pipe and adhesive shall be applied as suggested by the manufacturer.

3. Adhesive must be allowed to tack dry and then press surface firmly together starting from butt ends and working towards canter.

4. Wherever flat sheets shall be used it shall be cut out in correct dimension. All longitudinal and transverse joints shall be sealed as per manufacturer recommendations.

5. The insulation shall be continuous over the entire run of piping and fittings.

iv. Pressure Test

After completion of piping installation, the suction and liquid lines shall be pressure tested and repaired if necessary and further pressure tested to hold 1.5 times of working pressure for a minimum 24 hours with dry nitrogen prior to insulating the joints.

Systems shall be charged with Nitrogen to 4.5 kg/cm^2 (450 psi) gauge pressure and all joints shall be checked for leakages with soap solution. Leaks shall be marked, pressure released and repairs carried out. Brazed joints that leak shall be opened and redone. These shall not be required by addition of brazing alloy to the joint.

System shall be charged with nitrogen to the pressure specified as above. Leak detection and repairs to leaks shall be carried out till no leak exists.

After all leaks have been repaired; system shall be retested with test pressure maintained for not less than 8 hours. No measurable drop in pressure should be detected after pressure readings are adjusted for temperature changes. Pressure gauges and controls may be closed during pressure testing.

v. Charging

• Charge refrigerant in liquid form, through liquid line port

• Use weighing machine to charge exact calculated amount

• Weight the refrigerant cylinder before and after charging

• After complete charging open both suction and liquid ball valve of outdoor unit

• If full additional charge cannot be charge in liquid form, then charge balance amount in liquid form by using the suction service valve with system working in cooling mode

• After charging refrigerant remove manifold and refrigerant cylinder and replace caps of service valves

• Close (Front End) both suction and liquid service valves

• Check for leaks in service valve connections

vi. Commissioning

After refrigerant charging, energies the power supply to outdoor unit so that crankcase heater is energized for minimum 4 hours.

• Set dip switch settings.
• Check continuity of communication wiring
• Check all electrical connections are tight
• Check incoming voltage at power terminals
• Operate the indoor units by unit controller or group controller
• Observe for any abnormal noise
• Observe parameters and inside conditions for 12 hours
• Handover the system to customer along with user manual

vii. DRAIN PIPING

The drain piping shall be made out of rigid PVC pipes of 10 Kg/cm2 class. The piping shall be supported by clamping on MS angle 25mm x 3mm running continuously below the pipe. The piping shall be insulated with 6mm thick closed cell nitrile rubber sleeves.

The drain pans of IDUs shall be connected to rigid PVC pipe by braided PVC flexible pipe with appropriate adapters. U trap shall be providing in the drain connection of each IDU. All pipes support/clamps shall be painted with red oxide primer followed by two coats of synthetic enamel finish paint.

2.2.15 Control System or CENTRAL REMOTE CONTROLLER for VRV air conditioning system

Corded Remote Controller

1. Corded remote controller shall be supplied as specified in the “Bill of Quantities”. The controller must have crystal display screen, which displays complete operating status. The digital display must allow setting of temperature with 1 deg. C interval. Remote shall be able to individually program by timer the respective times for operation start and stop within a maxim um of 72 hours. Remote must be equipped with thermostat sensor in the remote controller that will make possible more comfortable room temperature control .The remote shall be able to monitor room temperature & preset temperature by microcomputer & can select cool/ heat operation mode automatically.

2. The remote must constantly monitor malfunctions in the system & must be equipped with a “self-diagnosis function” that let know by a message immediately when a malfunction occurs.

3. It shall be possible to wire the remote up to 500 RM T.

4. Cordless Remote Controller: Cordless remote controller shall be supplied as specified in the “Bill of Quantities”. The same operation modes & settings as with wired remote controllers must be possible. Compact light receiving unit to be mounted into wall or ceiling shall be included.

5. Central Remote Controller: Central Remote controller shall be supplied as specified in the “Bill of Quantities”.

Following functions shall be possible:

- Control Max 64 Groups (128 indoor units)
- Zone control
- Malfunction code display
- All the functions available with corded remote controller
- It should be possible to wire the remote to 1000m

The controller shall be integrated to BAS system thru software for monitoring & controlling of all above parameters including start/ stop of each indoor / outdoor unit. All necessary interface cards / units should be supplied as a part of the system to integrate to the BAS Software.

2.2.16 CONDENSATE:

1” dia PVC pipes & fittings shall be used from condensate from Evaporator Unit to drain point. The joints shall be properly sealed so that there is no water leakage. U-trap as required shall be provided at the end. Additional insulation drain tray shall be provided below the Evaporator Unit, if required.

2.2.17 MOUNTING:

All indoor units shall be mounted with Brackets, Hangers etc. With proper size anchor Fasteners.

2.2.18 FRESH AIR INTAKES:

Extruded aluminum construction duly anodized (20 microns and above) fresh air louvers with bird screen and dampers shall be provided in the clear openings in masonry walls of the air handling unit rooms having at least one external wall. Louvers, damper, pre-filters, ducts and fresh air fan with speed regulator shall be provided as shown on Drawings and in Schedule of Quantities. Fresh air dampers shall be of the interlocking, opposed-blade louver type. Blades shall be made of extruded aluminum construction and shall be rattle-free. Dampers shall be similar to those specified in "Air Distribution". Fresh air fans and fresh air intakes shall be as per the requirements of Schedule of Quantities.

2.2.19 PAINTING

Shop coats of paint that have become marred during shipment or erection shall be cleaned off with mineral spirits, wire brushed and spot primed over the affected areas, then coated with paint to match the finish over the adjoining shop painted surface.

2.2.20 PERFORMANCE DATA

All units shall be selected for the lowest operating noise level of the equipment. Fan performance rating and power consumption data, with operating points clearly indicated shall be submitted and verified at the time of testing and commissioning of the installation.

2.2.21 TESTING

Cooling capacity of various units models be computed from the measurements of air flow and dry and wet bulb temperatures of air entering and leaving the coil. Flow measurements shall be by an anemometer and temperature measurements by accurately calibrated mercury-in-glass thermometers. Computed results shall conform to the specified capacities and quoted ratings. Power consumption shall be computed from measurements of incoming voltage and input current.

a) ***TECH SPEC – 3 - EQUIPMENT SPECIFICTIONS FOR VENTILATION FANS***

CABINET / INLINE TYPE SINGLE SKIN FLOOR MOUNTABLE TYPE / CEILING SUSPENDED TYPE FRESH AIR & EXHAUST AIR FANS

2.3.1 GENERAL

The scope of this section comprises of supply and installation of Single skin cabinet type Fresh Air or Exhaust air unit with all its accessories conforming to this specification and in **accordance with the relevant drawings.**

The Air handling units / Ventilation unit shall be constructed using single-skinned powder coated GSS sheet of minimum 1.2mm.

The air handling unit's capacities, fan motor HP, fan static pressure & all other details are furnished in the equipment schedule & relevant drawings.

The entire unit shall be of sturdy construction to ensure freedom from vibration while running. All sections shall incorporate access doors/ panels. The hinges shall be of cast aluminium & handles shall be of pressed steel. Self-lubricated Nylon sleeves shall be provided. The entire housing shall be mounted on extruded aluminium / GSS channel frame work having pressure die cast aluminium / GSS jointers. All access doors, coil connections etc, shall be provided on one side of the unit. In other words, access to the other side of the unit should not be necessary for any purpose what so ever.

Special care shall be taken to ensure that doors, handles, hinges, etc shall be robust enough to with stand heavy industrial usage. The vibration of the EAU /VAU fans (as measured on the bearing block after assembly) shall not exceed a peak-to-peak displacement of 100 microns. For all EAUs /VAUs, serrated rubber pads shall be provided for vibration isolation.

COMPONENTS OF THE VENTILATION UNITS

The Exhaust Air Handling Units shall consist of the following sections for all the air handling units apart from below listed:

A) Components

a) 400mm Deep empty Section with Outlets having dampers for connecting exhaust air duct to the unit.
b) Fan Section (should be AMCA Certified)

B) Accessories

♋◑ 1 Set of Vibration Isolators (Rubber Pads) for each Air handling Units.

FAN SECTION

Fans shall have AMC certification. The ratings which are to be submitted along with the proposal shall be based on the tests and procedures performed in accordance with AMCA publication 311 and comply with the requirements of AMCA certified ratings program.

The fan shall be forward curved airfoil blades (please refer technical requirements) of non over loading characterizes, double inlet double with type (DIDW). The wheel and housing shall be fabricated from heavy gauge galvanized steel. The fan impeller shall be mounted on a solid shaft supported to housing with angle iron frame and pillow block heavy-duty ball bearings. Bearings shall be self-aligning, pillow block type selected for an average life of 200,000 hours at design operating conditions and shall be provided with grease line extending to outside of the AHU casing. The impeller & blades shall be selected /designed for quiet – running. The fan assembly shall be statically & dynamically balanced. A single impeller for the entire flow rate specified for the unit is preferred. The bearings shall be mounted on the scroll. Fan shall be driven by or internally unit-mounted motor connected to fan by V-belt drive. Access panel for easy belt change shall be provided for internally mounted motors. Belt connected motor capacity and shall adjustable to provide not less than ± 20% speed variation.

The fan & fan motor shall be assembled on a common frame which shall be mounted on the floor of the casing with spring vibration isolators. The fan outlet shall be connected to the casing with fire retardant fabric acting as a flexile connection to avoid any vibration from the unit on to the ducts. Fan motor shall be totally enclosed fan-cooled type and shall be suitable for 415V / 3Ph / 50Hz. Motor shall be sized to provide the additional power requirements when the fan is operated to provide an additional 20% of the rated capacity. The fan shall be selected for a noise level less than 65 dB.

MOTOR & DRIVE

Fan motors shall be suitable for 415 volts, 50 cycles, 3phase, squirrel case, totally enclosed fan cooled with IP-55 protection. Motor shall be selected for quote operation and the speed of the motor shall not exceed 1400 RPM. Drive to fan shall be provided through belt-drive arrangement. Belts shall of the oil-resistant type. Fan motor shall be suitable for variable speed by variable frequency drive application.

SAFETY FEATURES

Each Exhaust Air handling unit or Fresh Air handling unit shall have safety features as described below, but not limited to those listed below:

The fan access door shall be equipped with micro-switch inter locked with fan motor to enable switching off the fan motor automatically in the vent of door opening. The access door shall be further having wire mesh screen as an added safety feature bolted on to the unit frame.

Fan and motor base shall be properly earthen from the factory.
All screws used for panel fixing, projecting inside the unit shall be covered with PVC caps to avoid human injury.

Air handling units shall be selected for the operating noise level of the equipment. Fan performance rating and power consumption data, with operating points clearly indicating shall be submitted and verified at the time of testing & commissioning of the installation.

EVAPORATIVE COOLING SYSTEM (FAU)

General.

The evaporative cooling module shall be self-contained. It will consist of the component parts as listed in the following sections.

Quality Assurance.

The manufacturer shall:

a) Furnish proof satisfactory to the owner or his representative, of having manufactured evaporative cooler systems for a period of not less than five years.

b) Make its facility available to the owner or his representative for quality control audit without prior notification.

Submittals.

The manufacturer shall:

a) Submit product data, including dimensions, service connections, accessories, controls with schematics and sequence of operation, electrical nameplate data, and evaporative media data.

b) Furnish rigging, assembly, installation and maintenance instructions.

c) Furnish operation and maintenance manuals, including required descriptive vendor literature and parts listings.

Cooling components.

The evaporative cooler casing will be minimum (18) (16) gauge aluminized steel, welded to structural steel framing. All exterior seams are to be 100% weather tight. All interior surfaces will be cleaned of all oil and grease. Painted exterior will consist of a high quality prime coat and a finish coat of industrial enamel with rust inhibitors. Exterior color is to be selected by owner or his representative.

The evaporative cooler sump tank will be minimum (16) (14) gauge 304 stainless steel, the interior of which will be protected with an asphalt-based coating.

The evaporative cooler sump pump will be piped, wired, and fully assembled at the manufacturer's facility.

The evaporative cooler media shall consist of (6") (12") (18") thick Munters (CelDek®) (GlasDek®) media sized at a maximum face velocity of 600 fpm.

- 2" thick distribution pad manufactured from the same material as the evaporative media for uniform water distribution throughout the media thickness.
- 4" thick PVC drift eliminator to remove entrained water droplets from the leaving air side of the cooling media. Cooling media shall be easily removed for servicing and replacement.

The evaporative cooler module will also contain a float valve and switch, and labeled overflow, bleed, fill, and drain connections. A service panel shall permit easy access to the pump, float, and water regulating valve.

The evaporative cooler piping shall be schedule 40 (pvc) (copper), completely assembled and leak tested at the manufacturer's facility.

The evaporative cooler should include a submersible pump, UL. listed, hermetically sealed, dielectric oil-filled and with Buna-N seal. Horsepower rating of pump shall be conducive to the flow rate required and piping system installed. Pump to centrifugal type with strainer to prevent intake of solid material. The pump should be of 230 or 415 +/- 10% voltage. Pump shall discharge into a heavy-duty (pvc) (copper) distribution header. This header will have orifices of a size and quantity to adequately distribute water over and through the evaporative media. A water regulator valve should be installed in the distribution network to permit field adjustment of water flow over the media.

KITCHEN HOOD EXHAUST SCRUBBER SPECIFICATION

1. General

Kitchen Hood Exhaust scrubber is an air washer with refinement device which is used for cleaning kitchen fumes. The kitchen fumes are drawn from the kitchen hood through duct and enter the scrubber and flow horizontally.

The evaporative cooler casing will be minimum (18) (16) gauge aluminized steel,

Wet type kitchen scrubber, casing will be minimum (18) (16) gauge single skin metallic housing, welded to structural steel framing. All exterior seams are to be 100% weather tight. All interior surfaces will be cleaned of all oil and grease. And accommodating aluminium/GI pre metallic filter, intake louvers, double bank GI spray headers with brass spray nozzle and PVC water eliminator. The unit should be with SISW/DIDW centrifugal fan (fan section) to draw fumes through the scrubber and letting out relatively clean air. The water should re circulated by a pump through stump strainer. Painted exterior will consist of a high quality prime coat and a finish coat of industrial enamel with rust inhibitors. Exterior colour is to be selected by owner or his representative.

Horizontal Flow Fume / Kitchen Hood Exhaust Scrubbers

6. These fume / Kitchen Hood Exhaust scrubbers should be of Single stage packed bed type. Single Stage packed Bed should be capable to remove the bulk of the contaminant from the air stream and may be continuously wetted to prevent plugging.
7. Water Should be the media to removes pollutants from the air. When the water is re-circulated, addition of fresh water is necessary to purge contaminants and replace evaporation losses. Fresh water may be added to the recycle reservoir continuously or periodically.
8. Scrubbers are frequently used in applications where the air stream is being treated to remove acid fumes. The addition of chemical may be controlled manually or by a pH controller (Optional)
9. Access / Inspection ports are provided for inspection of the interior packing and mist eliminator elements. Hardware is MS.

Single Stage Packed Bed scrubbers complete with auxiliaries and options described herein. The system should include but is not limited to the following:

2. All scrubber internals necessary to provide adequate process capture and to achieve the designed performance.
3. Water spray system with spray nozzle, the water pipe (header / branch) should be of GI or Heavy duty PVC Pipes.
4. Mist eliminator to separate the water mist from carrying over.
5. SS Drain tray / water chamber with drain valve for to hold recirculation water.
6. Flanged connections for all external water fill, water makeup and drain, overflow piping as required.
7. Complete shop coating of required areas with coat or resistant paint for external surfaces.
8. Self-contained recirculation pump system.

2. MEDIUM PRESSURE CENTRIFUGAL BLOWERS

The exhaust fans supplied and installed should be of 'Centrifugal Corrosion Resistant' type and shall be capable of delivering the design flow rate against designed pressure drop.
The fans should be robust in construction and suitable for continuous duty operation. It shall be mounted with ease of maintenance and shall be installed with proper vibration isolators to minimize vibration transmission to ductwork and support structure.
Fans selected should be silent and vibration free when running and suitable for outdoor use and shall not exceed designed impeller speed.
Aerodynamic performance of the fan shall be tested and comply **'ISO 5801 / SMACNA'** standards.
Sound level shall be tested and comply with **'ISO 5136.2 / SMACNA'** standards.
Impeller material of construction shall be **fire retardant polypropylene (PPs)** for fan size up to 400 (polypropylene {PP} for fan size 450 and above) suitable for use against corrosive 'medium' and a maximum allowable operating temperature of 70°C.
Electro-galvanized stand shall be used to support the fan and the motor for fan sizes up to 400 in view of the corrosive environment. Sturdy metal galvanized steel stand shall be used from fan size 450 onwards.
A standard hub seal shall be fitted onto the impeller hub to prevent the corrosive 'medium' from contacting the shaft.

3. SPECIFICATIONS FOR MOTOR AND ACCESSORIES

Use an electric motor built to IEC standards foot mounted (B5) or Flange mounted (B3), also in ex-protected or multistage versions, for the drive. The impeller hub is coated with aluminium. Power transmission from motor to impeller by means of an impeller directly fixing on the motor shaft in direct driven application. The impeller is fixed on to a flange bearing and the tightening adopter system guarantees secure mechanical connection.

Motor Standard IEC three-phase motors in accordance with IEC.

The fan shall be driven by a standard TEFC electric motor with class 'F' insulation and class 'B' temperature rise unless otherwise mentioned. Motor shall be suitable for outdoor installation with IP55 protection and suitable for operation with 415V/3Ph/50Hz electrical supply. Motor supplied shall be in accordance to IEC standards.

PERFORMANCE DATA

Air handling units shall be selected for the lowest operating noise level of the equipment. Fan performance rating and power consumption data with operating points clearly indicating shall be submitted and verified at the time of commissioning of the equipment.

FACTORY TESTS

The contractor /manufacturer shall describe the tests that will be conducted at their works on the Air Handling Units. They shall furnish a test certificate / certificates to the effect that such tests have been duly performed on the AHUs.

Tests shall be conducted on all AHUs at the factory for measurement of delivery vs. static Pressure, total pressure, BKW, efficiency & noise level at 10%, 80% 60% , 50% & 404 speeds. The Consultants /Project Managers shall be intimated in advance of the date of the tests, which they will witness at their option.

4.TECHNICAL DATA SHEET for FRESH AIR & EXHAUST AIR FANS

(Contractor should be filled for each type of FA & EA UNITS)

Sl.No	Description	Consultant Specification	Vender Specification
1	Area Serving	Refer BOQ	

2	Type of Unit –Necessary test certificates should be attached for AMCA certification. (In build canopy over the unit)	Outdoor Mountable type double skin cabinet type SISW forward curved fan with AMCA certification	
3	Total air flow rate to Exhaust -wg	Refer BOQ	
4	Fan external static pressure –mm wg	Refer BOQ	
5	Suggested Fan motor –kW	Vender to Specify	
6	Type of fan motor	TEFC Squirrel Cage	
7	Empty section with volume control damper for connecting exhaust air duct from Kitchen	Required	
8	In build Canopy	Required	
9	Noise level		
	a) At the outlet of the fan	60dBA	
	b) Any where around the unit at 1.5M distance	55 dBA	

DATA TO BE FURNISHED BY THE CONTRACTOR AFTER THE AWARD OF CONTRACT

10 Quality Assurance Plan (QAP)
11 Dimensioned general arrangement drawing of FA / EA Unit.
12 Cross-sectional drawings of the FA / EA Unit with complete part list, material of construction and relevant standards for each part.
13 FAN performance curves flow rate Vs head, BKW, efficiency and torque-speed curve.
14 Driver dimensional drawing
15 Surface preparation and painting procedure
16 Catalogues, data sheets and drawings for instruments.
17 Installation, operation and maintenance manual.

b) ***TECH SPEC - 5 - HVAC SYSTEM TESTING & BALANCING***

2.4.1 Air Systems Testing, Adjusting, And Balancing

General

Work Included

This section specifies the requirements necessary for services required to measure, test and adjust, and record, complete, the air system capacities to match design conditions for airflow capacity and space pressurization. The air systems to be tested, adjusted, and balanced include but are not limited to:

General purpose and comfort air handling systems.
General purpose and building exhaust systems.

Qualifications

All air systems shall be tested and adjusted under the direct supervision of a qualified registered professional engineer, or an independent firm specializing in air system testing and balancing. The contractor's Project Manager shall have a minimum of 5 years of experience testing and adjusting building air handling systems. He shall supervise all aspects of field measurements, select appropriate tests, consult with contractor and Consultants on technical matters, and approve the test report. The contractors Field Engineer shall have a minimum of 2 years of experience testing and adjusting air handling systems as a field engineer or field technician. He shall supervise all field technicians assigned to complete the testing and adjusting of the work

covered by this section, and shall be responsible for all onsite testing and data acquisition. No field tests shall be taken without Consultants / Project Managers presence. All field technicians shall have completed previous training in building mechanical systems and air balancing procedures, shall have worked in this capacity on atleast one other similar project, and shall only work under direct supervision of the Field Engineer.

Submittals

Provide the following in addition to the standard requirements with the Bid:

Qualifications of all field technicians, the Field Engineer, the Project Manager, Pertaining to execution of HVAC system A list shall be available upon request of projects similar in size and complexity to this project that the firm has completed. Include the project name, description of mechanical system, range of services provided, and the name and phone number of the design consultant or Consultants who had responsibility for final inspection and acceptance of the service.

A list shall be available upon request of projects similar to this project that the Field Supervisor or project Manager has managed and/or adjusted. Written presentation outlining the testing, adjusting, and balancing procedures to be performed. Description of all instrumentation and test equipment to be used, as well as calibration documentation. Samples of all field reports, charts and forms proposed to document measured conditions. A sample test report for a similar project shall be available for inspection by contractor and Consultants to verify the Subcontractors expertise is data collection and interpretation.

Required at completion of Balancing Work:
Orderly computerized field reports, charts, and forms completed with all measured data. Description of operating condition of all general purpose and clean areas. Reduced set of architectural floor plan drawings, maximum size 11 by 17 inches, showing all sample points referred to on other field data sheets. Separate section in the report outlining any operating or balancing problems remaining at the end of the testing and adjusting procedures. Describe the condition and its effect on the room pressurization levels and the recommended remedies.

A list of all instrumentation and test equipment actually used in the balancing process, including manufacturer, model and has calibration date. Description of all tests performed, including the purpose, instrumentation, procedure, results and analysis of the data. All data shall be properly presented and graphically displayed to permit full understanding of all tests. Include the date test were taken and the field technicians performing the tests. Six copies of the completed Air Balancing Report shall be submitted by Contractor for Consultant’s review and acceptance.

Products

Authorized Balancing Agencies

Materials and Testing Equipment
he Subcontractor shall supply all materials, tools, equipment, and Instrumentation required to perform the air system balancing as described in this section. All test equipment used in the testing and balancing procedure shall be precision instruments recognized by the industry as being applicable for the intended use. Coordinate work with section 15951, piping systems Adjusting and Balancing. Calibration of equipment shall be traceable to NBS Standards within the previous 12 months.

Air velocity measurements shall be taken with a calibrated air measuring cone. In areas where in air measuring cone is not practical, a Velgrid velocity instrument, registered by Short ridge instruments, Will be accepted to take direct velocity measurements at the face of the ceiling outlet. Pressure differential measurements shall be taken with a portable liquid-filled inclined manometer or a magnahelic guage, or equivalent calibrated instrument Noise Level Tests shall be taken with precision sound level meters recording data in all eight octave bands as well as the third level band. Sound meter shall be Bruel and Kjaer, or similar, by General Radio. Airflow in ducts

shall be measured with a pilot tube, if sample ports are specifically provided. (Do not drill coated stainless steel exhaust ducts.)Drill and plug duct at sample point. Sample in center of equal areas of ducts.

Execution

Preparation
Pre-balancing Conference: Prior to commencing with balancing, the Subcontractor shall meet with project Managers and Consultants and Certification Agency to review the systems and the balancing procedures, and to ensure that the Subcontractor has a full understanding of the requirements.

Equipment Verification:
Identify all equipment to be tested. Verify that the equipment installed corresponds with the latest shop drawings and that ducting and piping correspond with the latest plans. Notify Contractor of any deviations that may cause under performance. Record the installed size, type, manufacturer, rating and capacity of all equipment to be tested, including air outlets and inlets.

2.4.2 General Air Balancing Procedures

General:
Adjust air systems in accordance with standard procedures and recognized practices of the Associated Air Balance Council.

Fan and airflow adjustments have been corrected for the jobsite elevation airflow values shown are the actual air quantities necessary for proper heat transfer. The Balance Logs shall indicate the recorded jobsite values, and all velocity and mass correction factors used to provide equivalent standard air quantities.

Outlets and Inlets:
Adjust diffusers, registers, and grilles for proper deflection, throw and coverage. Check for drafts and noise, and eliminate where possible. Adjust diffusers installed as four-way blow to three-way or two-way blow if required to eliminate collision of airstreams.

Adjust air volumes for supply diffusers and grilles, and for return and exhaust grilles to the quantities shown , with allowable variation of plus 10, minus 0 percent.

Mark final positions of all balancing dampers with felt pen. Recommend addition or replacement of dampers as necessary to obtain proper air control. When major adjustments are made to a portion of any fan system, all other portions of that same system must be reread to determine the effects imposed by the adjustments.
Equipment:

Air Moving Equipment:
Adjust fan speeds, active wheel widths, or blade settings to obtain required equipment air volumes, with allowable variation of plus 10, minus 0 percent. After final adjustment, motor amp draw shall not exceed nameplate amperage on any phase, and fan must not exceed ist maximum rated RPM. Perform airflow test readings under simulated or actual conditions of maximum cooling maximum heating minimum outside air, maximum outside air and exhaust, and maximum return air.

When directed, make all drive and belt changes, furnishing belts and sheaves to adjust equipment to the specified conditions. Provide written notice to all air handler manufacturers if any drive or belt changes were made.

Adjust all outside air dampers, supply dampers, return air dampers, bleed off air dampers, and exhaust air dampers for air requirements.

Record static pressure readings at each unit inlet and discharge, and on inlets and outlets of filters, coils, dampers and plenums for every supply, return and exhaust fan, and for all air handlers.

Record equipment nameplate data on all fans, motors, heaters, coils etc., indicating equipment identification, motor and drive data, and starter and heater data.

Air Terminal Units:
Measure the difference between inlet and discharge static pressures to ensure that sufficient pressure differential exists for the terminal unit to operate in control.

Verify that terminal unit controls are operating properly, that stroke is from full open to full close, and that operation is smooth and without binding. If corrective measures are required, notify the controls installer.

Verify that sensors are free of blockage and sensing a fully developed air flow profile.

Set air terminal unit volumes using the inlet velocity probe when provided with unit. Where upstream conditions prevent accurate readings, measure the air volume using a pilot traverse at an alternate location where accurate readings may be taken. Only in the absence of an acceptable traverse point may methods such as controller set point, sums of the outlets, down streams pitot traverse, and mixed temperature be used to determine terminal unit air volume. Two confirming readings using different methods shall be taken.

Record inlet and outlet static pressures with terminal units set to design maximum air volume.

SECTION 15995

2.4.3 Systems Startup And Commissioning

General
Work Included
This section specifies the requirements for pre-balance, start-up, and commissioning of mechanical systems, including, but not limited to:

e) General purpose and comfort air handling systems / VRF or VRV / Dx. Ductable Indoor units.
f) General purpose and building exhaust systems.
g) Chilled water systems VRF or VRV system.

Requirements for the following are included:

f) HVAC systems pre-balancing.
g) HVAC systems manual run.
h) HVAC systems balancing.
i) HVAC control system testing.
j) HVAC systems commissioning.
k) HVAC systems 72-hour acceptance test.

Related Work:
This section shall be used in conjunction with the following the specifications and related Contract Documents to establish the total standard requirements for HVAC systems start up and commissioning.

Provide services described in this section and in accordance with consultants start up Program see the Systems start up and commissioning Appendix, at the end of this section. Contact Consultants for a copy of this document.

Quality Assurance

ASHRAE Project Managers Guideline 1, The HVAC Commissioning Process.

Definitions

2.4.4 HVAC systems commissioning consists of the following:

Verify operation and functional performance of HVAC systems for compliance with design documents. Document HVAC test inspections. Verify application of operation and maintenance manuals, as-built (record) documents, spare parts listing, special tools listing, and other items as may be specified herein for support of HVAC systems and equipment. Coordinate and direct training to personnel for operation and maintenance of HVAC equipment and systems.

Documentation

The Subcontractor shall prepare and have ready the following documents at the start of commissioning:

Project plans and specifications (Subcontract documents), authorized revisions, HVAC shop drawings and submittals (approved), test and balance reports, equipment start up and certification reports et.,

Records of required code authority inspections documentation signoff, etc.,

Submittals

a Submit the following for approval prior to starting the commissioning process:
b Commissioning plan (Scheduling, sequence, documentation requirements, verification procedures, staffing requirements, etc.,)
c Training plan (scheduling, sequence of training personnel involved, etc.,)
d Tool list.
e After commissioning is complete, the subcontractor shall submit all documentation obtained During
f The commissioning process to Contractor.

Products

Instrumentation

Instrumentation shall be provided by the Subcontractor or agency performing prior tests. Instruments shall be operated by individual Subcontractor or agency as requested by Subcontractor.

Execution

General

Subcontractor personnel involved in commissioning (commissioning team) shall actively participate in construction phase of the project to ensure compliance with HVAC commissioning requirements.

Procedure

g Commissioning team shall attend pre-construction meeting and establish requirements for HVAC commissioning authority process throughout construction phase.

h Commissioning team shall prepare and submit to Contractor and Consultants an HVAC commissioning outline which shall include:

i Responsibility of each trade affected by HVAC commissioning, as required by appropriate paragraph of this section.

j Requirement for documentation of commissioning process.

k Requirements for documentation of HVAC test and inspections required by code authorities.

l Format for training program for operation and maintenance personnel.

m Commissioning team shall periodically attend construction and coordination meetings.

2.4.5 HVAC systems Pre-Balance

Subcontractor shall perform the following work for pre- balancing of all air and hydraulic systems:

Prior to completion of the duct and piping systems, the mechanical subcontractor shall coordinate and fully cooperate with the balancing subcontractor. All drawings shall be checked, and any dampers, balancing valves, or devices not shown on the drawings, but necessary for proper balance as determine by the balancing subcontractor, shall be added or relocated at no additional cost. After completion of the duct and piping systems, the mechanical and balancing subcontractors shall both certify, in writing, to contractor that the systems have been checked and that all devices are installed to facilitate the balancing work.

- Complete all duct and piping pressure testing as specified.
- Complete all punch list items which may affect balancing.
- Remove all shipping and storage protection; remove shipping locks from vibration isolators and clean debris from under all isolated equipment.
- Check all motors for rotation. Log RPM, voltage, and amps.
- Check starter heater size for conformance with motor nameplate data.
- Adjust and align all sheaves and belts; set all adjustable sheaves to provide specified RPM. Ensure all rotating components turn freely without interference or binding.
- Install temporary construction filters or media as required.
- Set all dampers, diffusers, grilles, extractors, inlet vanes, valves and balance valves to the full open position.
- The controls subcontractor shall, either via the control system or manually at each device, fully open all automatic control valves and dampers.
- Drill all probe holes required for static pressure readings, pitot tube traverse readings, and temperature readings. Coordinate locations with balancing subcontractor. Install plastic plugs in all such holes.
- Clean interior of all plenums, casings, and ducts and install all specified filters.
- Lubricate all equipment per manufacturer's recommendations and provide access to lubrication fittings as required.
- Align all pumps and ensure that bases are grouted as required; check alignment of all flexible pump connectors.
- Flush clean all piping systems from debris. Treat piping systems with chemicals, if required.
- Fill, bleed and charge with chemicals all piping systems.
- HVAC Systems Manual Run

○ Upon the completion of above and the submission of the documentation required for above items, the subcontractors shall perform the following:

- Charge and start chillers, boilers, cooling towers, pumps, and all other major pieces of equipment. Manufacturers' representatives shall perform the start up of all major equipment. Setting of all operating

and limit equipment controls shall also be by manufacturers representative. Log all settings and furnish a start up report for each piece of equipment.

- Check all systems and equipment for excessive noise and vibration. Check and adjust all spring isolators and replace any that are “bottomed out”. Any problem area shall be reported to Contractor and Consultants for corrective action.

- Perform final vibration balance and testing for equipment requiring vibration balancing after installation as specified.

- Operate all equipment manually (in the LOCAL or HAND mode) for a minimum of 5 consecutive 8-hour days. All variable frequency drives shall be set to HAND or MANUAL (not BYPASS) with the output set at 100 percent. Repair or replace any piece of equipment which fails during this period and restart the test for that machine.

- After such time as all systems have been successfully operated for the aforementioned 5-day period, the mechanical subcontractor shall so notify Contractor so that the balancing subcontractor may begin his work.

- At the completion of the above test run, remove all start up strainers. Clean all permanent strainers. Replace temporary filters and/or clean permanent filters. Generally, make all systems ready for full time operation.

2.4.6 HVAC Systems Balancing

13. Air and water balancing have been specified under separate paragraphs of this section. The Subcontractors shall provide the following support during balancing:

14. Make available a qualified technician for 10 man-hours to assist and instruct the balancing subcontractor. The Subcontractor shall document (via daily time vouchers signed by Contractor) any labour thus expended. At the completion of the project the Subcontractor shall credit to Contractor any unused labot at standard hourly rates per the BID Form.

15. The mechanical subcontractor shall operate and maintain all equipment and systems for the use of the balancing and controls subcontractors from the time of initial start up until the successful completion of the final 72-hour test, Consultants acceptance, and start of the warranty period.

16. It shall be the responsibility of the balancing subcontractor to determine and convey to the mechanical subcontractor to determine and convey to the mechanical subcontractor the sizes of any required fan sheave changes. Any sheave replacements shall be the responsibility of the balancing subcontractor and will be treated as a change order for this project.

2.4.7 HVAC Control System Testing

- The control system testing phase required that the controls subcontractor, with assistance from the mechanical subcontractor as necessary, perform a complete checkout and verification of the proper operation and calibration of all system points, sequences , interlocks with associated systems (e.g., fire alarm and equipment switchover for backup), and loop functions. The purpose of this phase of work is to place the system into automatic operation in preparation for verification of the mechanical and controls system operation by the 72-hour system acceptance test.

- The testing phase will consist of the following steps:

- Field testing and verification (loop checks).
- Performance Verification.

- Test 1 is conducted by the controls subcontractor. This portion of the test verifies accurate wiring and pneumatic connections from control devices i.e., sensors, valves, thermostats, damper actuators, switches, relays and control panels.
- All sequences of operation specified and identified in the drawings and specifications shall be tested. Calibration of sensors, transmitters, controllers, and actuators to achieve set point tolerance for all control loops shall be accomplished during this test.

- The controls subcontractors shall submit checklist forms to contractors for approval at least 2 weeks prior to beginning Test 1. These forms shall identify all devices, sequences, set points, etc., which are to be tested as part of Test 1.

- Project Managers and Consultants may choose to observe any or all of the testing performed for Test 1.

- Test 2 is the demonstration by the controls subcontractor to Contractor and Consultants that all equipment is tested and ready for final system commissioning.

- Test 2 will be started after three prerequisites are met:

  - Test 1 must be completed by the subcontractor.
  - The completed Test 1 checklist have been submitted to and approved by project Managers and Consultants.
  - The controls subcontractor shall certify in writing that each wiring and pneumatic connection has been checked, the operation and calibration of each device has been verified, all sequence have been observed, and all have been found to be complete and operational.

2.4.8 HVAC Systems Commissioning

a) HVAC systems commissioning shall begin after the pre-balance, manual run, air and water balancing, and control system testing phases are completed.

b) Consultants and Project Managers shall be included in the commissioning process.

c) Verify air and water balancing readings, such as supply and return air quantities, fan performance, hydraulic performance, branch duct readings, boiler performance, chiller performance etc.,

d) Verify calibration of temperature sensors, relative humidity sensors, dew point sensors, pressure transmitters, and related controls, such as damper settings, valve positions, VAV boxes, etc.,

e) Verify readings of remote data and control systems, such as temperature, relative humidity, dew point, pressure, damper positions, variable frequency drive settings etc.,

f) Verify operation of system modes, such as humidification / dehumidification, smoke purge system operation, equipment failure and backup unit start up etc.,

g) Verify that total HVAC systems are performing to provide conditions outlined in design documents such as temperature control, humidity control, pressurization control, control system response, etc.,

2.4.9 Mechanical and Electrical 72-Hour Systems Acceptance Test

- The purpose of the 72-Hour systems test is to demonstrate that the overall system will function reliably and in accordance with the design documents.

- Systems that are capable of producing trend logs for control points shall be utilized to produce these logs to record the status of temperature, pressure, humidity, et., during the test. The points to be mentioned will be determined by Contractor and Consultants.

- The 72-hour test is a prerequisite to obtaining a notice of Substantial Completion for the mechanical, electrical and control systems. Equipment and systems warranties shall begin with Substantial Completion and acceptance by Consultants

- Successful completion of the 72-hour test is a prerequisite to obtaining a notice of substantial completion for the mechanical, electrical and control systems. Equipment and systems warranties shall begin with substantial completion and acceptance by Consultants.

- All HVAC systems and associated control and alarm interlocks shall be operated for a period of 72 consecutive hours. During the 72-hour period, all systems shall function in a completely automatic mode without any equipment shutdown of malfunction. All system shall operate to maintain design sequences and conditions.

- Any system shutdown, malfunction, or deviation from design sequences during the 72-hour test will be cause to discontinue the test and restart after faults are corrected. Consultants will determine if a failure is severe enough to discontinue the test.

Appendix
Package_____

TAG NO.	REV.
Consultants Startup Program	

Section – 3 - APPROVED MAKES OF MATERIALS

2.1 **3.1** ***LIST OF APPROVED MAKES FOR AIRCONDITIONING AND MECHANICAL VENTILATION (ACMV) SYSTEM***

SL No	**Details of Equipment's / Materials**	**Approved Make**
1	Dx. VRF or VRV/Dx. Ductable /Split Air-Conditioners	LG / Samsung / Daikin / Thoshiba / Mitsubishi / Blue Star / Voltas /
2	Medium Pressure Single Skinned Fresh Air Evaporative Cooling System with / without insulated panel & Filters –	Caryaire / Clivet or VTS (Bangalore) / Zeco / Edgetech / Saveair / Humidin / System Air /AMBASSADOR Note :- Fans should be of Kruger / Nicotra / Comefri
3	Cabinet Type Exhaust Fans with wet scrubber, Centrifugal Type exhaust Unit for fume hood exhaust.	Caryaire / Clivet or VTS (Bangalore) / Zeco / Edgetech / Saveair / Humidin / system air / AMBASSADOR Note :- Fans should be of Kruger / Nicotra / Comefri

8. Instructions for Online Bid Submission

(Department User may attach this Document as an Annexure in their Tender Document which provides complete Instructions for on line Bid submission for Bidders)

The bidders are required to submit soft copies of their bids electronically on the CPP Portal, using valid Digital Signature Certificates. The instructions given below are meant to assist the bidders in registering on the CPP Portal, prepare their bids in accordance with the requirements and submitting their bids online on the CPP Portal.

More information useful for submitting online bids on the CPP Portal may be obtained at: https://eprocure.gov.in/eprocure/app.

REGISTRATION

1) Bidders are required to enroll on the e-Procurement module of the Central Public Procurement Portal (URL: https://eprocure.gov.in/eprocure/app) by clicking on the link "Online bidder Enrollment" on the CPP Portal which is free of charge.

2) As part of the enrolment process, the bidders will be required to choose a unique username and assign a password for their accounts.

3) Bidders are advised to register their valid email address and mobile numbers as part of the registration process. These would be used for any communication from the CPP Portal.

4) Upon enrolment, the bidders will be required to register their valid Digital Signature Certificate (Class III Certificates with signing key usage) issued by any Certifying Authority recognized by CCA India (e.g. Sify / nCode / eMudhra etc.), with their profile.

5) Only one valid DSC should be registered by a bidder. Please note that the bidders are responsible to ensure that they do not lend their DSC's to others which may lead to misuse.

6) Bidder then logs in to the site through the secured log-in by entering their user ID / password and the password of the DSC / e-Token.

SEARCHING FOR TENDER DOCUMENTS

1) There are various search options built in the CPP Portal, to facilitate bidders to search active tenders by several parameters. These parameters could include Tender ID, Organization Name, Location, Date, Value, etc. There is also an option of advanced search for tenders, wherein the bidders may combine a number of search parameters such as Organization Name, Form of Contract, Location, Date, Other keywords etc. to search for a tender published on the CPP Portal.

2) Once the bidders have selected the tenders they are interested in, they may download the required documents / tender schedules. These tenders can be moved to the respective 'My Tenders' folder. This would enable the CPP Portal to intimate the bidders through SMS / e-mail in case there is any corrigendum issued to the tender document.

3) The bidder should make a note of the unique Tender ID assigned to each tender, in case they want to obtain any clarification / help from the Helpdesk.

PREPARATION OF BIDS

1) Bidder should take into account any corrigendum published on the tender document before submitting their bids.

2) Please go through the tender advertisement and the tender document carefully to understand the documents required to be submitted as part of the bid. Please note the number of covers in which the

bid documents have to be submitted, the number of documents - including the names and content of each of the document that need to be submitted. Any deviations from these may lead to rejection of the bid.

3) Bidder, in advance, should get ready the bid documents to be submitted as indicated in the tender document / schedule and generally, they can be in PDF / XLS / RAR / DWF/JPG formats. Bid documents may be scanned with 100 dpi with black and white option which helps in reducing size of the scanned document.

4) To avoid the time and effort required in uploading the same set of standard documents which are required to be submitted as a part of every bid, a provision of uploading such standard documents (e.g. PAN card copy, annual reports, auditor certificates etc.) has been provided to the bidders. Bidders can use "My Space" or ''Other Important Documents'' area available to them to upload such documents. These documents may be directly submitted from the "My Space" area while submitting a bid, and need not be uploaded again and again. This will lead to a reduction in the time required for bid submission process.

Note: My Documents space is only a repository given to the Bidders to ease the uploading process. If Bidder has uploaded his Documents in My Documents space, this does not automatically ensure these Documents being part of Technical Bid.

SUBMISSION OF BIDS

1) Bidder should log into the site well in advance for bid submission so that they can upload the bid in time i.e. on or before the bid submission time. Bidder will be responsible for any delay due to other issues.

2) The bidder has to digitally sign and upload the required bid documents one by one as indicated in the tender document.

3) Bidder has to select the payment option as "offline" to pay the tender fee / EMD as applicable and enter details of the instrument.

4) Bidder should prepare the EMD as per the instructions specified in the tender document. The original should be posted/couriered/given in person to the concerned official, latest by the last date of bid submission or as specified in the tender documents.

5) Bidders are requested to note that they should necessarily submit their financial bids in the format provided and no other format is acceptable. If the price bid has been given as a standard BoQ format with the tender document, then the same is to be downloaded and to be filled by all the bidders. Bidders are required to download the BoQ file, open it and complete the white coloured (unprotected) cells with their respective financial quotes and other details (such as name of the bidder). No other cells should be changed. Once the details have been completed, the bidder should save it and submit it online, without changing the filename. If the BoQ file is found to be modified by the bidder, the bid will be rejected.

M/s. Indian Institute of Management, Bangalore		
Bill of Quantities for Proposed Additional & Modifications Works to Existing MDC Block @ Survey No 47, Mahanthalingapura Village, Jigani Hobli Anekal Taluk, Bengaluru urban district.		
Sl No	Works	Amount
Part A	Civil Works	-
Part B	Electrical Works	-
Part C	a)HVAC Works	-
	b) HVAC Works for VRF for Materials	-
	Total	-
	Add 18 % GST	-
	Add 28% GST	-
	Grand Total	-

Indian Institute of Management, Bangalore					
Bill of Quantities for Proposed Additional & Modifications Works to Existing MDC Block @ Survey No 47, Mahanthalingapura Village, Jigani Hobli Anekal Taluk, Bengaluru urban district.					
	Part A : Civil Works for MDC Block @ IIMB New Campus Survry No 47, Mahantalingapura, Jigani Hobli, Anekal Taluk ,Bengaluru				
Sl No	**Description**	**Unit**	**Qty**	**Rate**	**Amount**
I	Aluminium Partition Works for the Dining Area			in Rs.	in Rs.
1	**Unitized Punch Window Curtain Wall System with combination of fixed and sliding windows as per detailed drawing in all elevation**				
	Design, supply and installation unitized four sided structural glazing system curtain wall custom designed to with stand the design wind pressure 2.5kPA confirming to IS -875 part III.The system must pass the proof test at 1.5 times design wind pressure without any failure, with silicon gaskets in exposed grooves and microwave cured EPDM gaskets in unexposed area, structural and weather sealants of Dow Corning or approved make, Norton spacer tape,backer rod, Bracketing system with MS/aluminium alloy of 6005 T6 brackets designed to accommodate three dimensional movements with serrated plate and serrated washers, SS 316 grade fasteners and anchor bolts of approved make, nylon separators to prevent bi-metallic corrosion, flashings to seal the gaps between curtain wall and the building structure all complete required to perform as per specification and drawing in conjunction with BOQ.				
	The system design shall be based on Non-thermal break principles. The system design shall include pressure equalization with Three barrier gaskets for improved thermal performance and weather performance, drainage at all floor level through bottom subcill gutter profile, spandrel panel shall have pressure release & condensation drainage provisions, to accommodate building movements, thermal expansions and the seismic movements. All metal joints in the wet area shall be small joint sealant applied to ensure water tightness.				
	Each glass panel shall be structurally glazed on the main unitised panel profiles. Each glass panel shall be supported for dead load at the bottom of glass in main Unitized system.				

	The system shall be designed of floor height units with wind resistance subcill gutter at floor level and wind load & Dead load bracket at top with provision to accommodate movement at all floor levels and at every grid panels horizontally.The system shall be designed to accommodate 10mm and 8mm SGU glass in vision area. System shall accomodate openable panel as per architectural requirment in the unitised system as per the design drg. All fix vision glass and openable shall look similar in the elevation.				
	The design of drain gutter profile container shall be deep enough to contain and drain water entering 2nd barrier. The design shall also provide slope in gutter profile with drain slots of sufficient size.				
	All in between mid transome shall be flush with mullion.				
	The complete system shall demonstrate performance for air seal / water seal / structural /seismic requirement. Onsite test for workmanship verification shall be carried out in stages for water penetration hose test as per AAMA 501.2 at minimum 6 locations.				
	The extruded aluminium sections of Alloy 6063 T5 / T6 & tolerances confirming to DIN / EN standard from approved extruder. The structural profiles shall have minimum wall thickness to satisfy structural stability. All the profiles shall have minimum 60 -80 microns 15 years warranty powder coating finish as per AAMA 2603 specification with powder coating from Akzonoble/Jotun. The non visible aluminium surfaces shall have minimum chromatizing treatment.				
	All shade approval shall be as per existing shade only				
	The quote rate shall include all design, engineering & shop drawings				
	Unitised Strip window curtainwall system				
1	Quote rate only for Complete system in Unitized system with 10mm ST167 Reflective Toughened Glass	Sqm	80.00		-
					-

2	Designing, fabricating, supplying, assembling and fixing in position as per site conditions the Patch fitted Glass Door with double shutter, made of 12mm thick clear toughened glass, edge polished, toughened glass of Saint Gobain make as per the approved shop drawings. The glass shutters shall be supported on Dorma/Haffle/Sway make Heavy Duty patch fittings at top finished with brushed finished stainless covers and Dorma/Godrej/Savex make heavy duty Floor spring at the floor level at the approved shop drawings adhering to manufacturers specifications. This also includes providing necessary profiled cut-outs and enough numbers of machine made holes to facilitate fixing of patch fittings, handles, locks etc as per the hardware manufacturers specifications. All the edges of the glass panels including profiled cutting shall be neatly machine polished as per the manufacturer's specifications. This includes providing and fixing in position necessary stainless steel hardware like H-handles (40mm dia., 450mm long), patch lock etc. Dorma/Haffle, Sway make as per the approved shop drawings. This also includes providing necessary cut-out in the RCC floor slab, Granite/Marble floor adequate to fix the floor spring and finishing the same neatly after installation of floor spring as per the approved shop drawings. The mode of measurement for payment shall be based on the elevation area of the Doors. All glass panels to be have protective film coating till hand-over. **Glass shall be of Saint Gobain/Ashai/ Atultuf/Arihant/Equivalent**	Sqm	8.00		-
	SUB TOTAL EXCLUDING GST				**-**
II	**For Rain Splash Area**				
1	Providing and constructing **200mm thick Walls with Solid Cement Concrete Blocks** conforming to IS 2185 with a mini-mum crushing strength of 35 Kgs/sqcm in cement mortar 1:4, in superstructure at all levels and heights including all neccessary Staging and Scaffolding complete as per specifications.	Sqm	10.00		-
					-
2	Providing 15mm thick cement plaster in single coat with cement mortar 1:4 to block masonry including rounding off corners wherever required with smooth rendering, Providing and removing scaffolding, including cost of materials, labour, curing including lead & Lift at all levels and Heights complete as per specifications including cost of materials, labour, curing providing grooves at all wall and ceiling junctions 12x12mm Rate shall include for providing of Arpitha/Sachira industries plastering Mesh 125mm wide for all junctions of concrete and masonary surfaces in Horizontal and Vertical areas., and along the route of walls chipped / chased for services, including leads and lifts at all Levels ,cost of materials, labour for fixing complete as per specifications. No Extra cost shall be paid for Double Heights areas. **(Internal Walls)**	Sqm	30.00		-

					-
3	Providing and applying **Birla White wallcare putty-SF** or equivalent to **walls & Ceiling** in two coats total thickness of the coats limited to a maximum of 1.5mm. The surface should be thoroughly cleaned of all loose material and shall be clean, free from dust, grease and loose material and shall be fully cured with clean water. Mixing and application of putty shall be as per manufacturers instructions. including preparing the surface, even and sand paper smooth, cost of materials, labour, HOM of equipments and machineries, including leads and lifts at all levels & Heights, Loading and unloading, transportation , all other incidental charges at all floor levels etc., complete all as per specifications and as directed by the Engineer-in-charge. No Extra cost shall be paid for double height areas.	Sqm	30.00		-
					-
4	**For Internal Walls & Ceiling:** Providing and applying painting in **two coats** with **PLASTIC EMULSION** Paint over a coat of primer of approved brand and shade to give an even approved shade after throughly brushing the surface, free from mortar drops and other foreign matter including preparing the surface even and sand paper smooth, including lead & Lift lift at all levels & heights, cost of materials, labour complete as per specification	Sqm	30.00		-
	-				-
5	Providing and fixing **18mm to 20mm thick Antique finish Sira Granite for Railing wall Top Coping in** CM 1:3 including Rounding of Exposed Surfaces etc complete as per drawing. **(Basic Price Rs. 140/Sft including GST landed at site)**	Sqm	12.00		-
					-
6	Providing and fixing of 1mm thick M.S. sheet door with frame and diagonal braces of size 40x40x6mm angle Iron, 3.15mm thick M.S. Gusset plates at the Junctions and corners, with handles, stoppers and Locking arrangements etc, including applying a priming coat of red lead paint cost of materials, labour, HOM of machinery complete as per specifications.The rate shall also include for providing and applying enamel metal Paint two coats (excluding Priming coat) over new steel or other Metal Surface brushing to give an even shade after cleaning Oil, grease, dirt and other foreign Matter, including cost of materials, labour, compete as per specifications	Sqm	5.00		-
					-

7	Designing, fabricating, supplying, assembling and fixing in position as per site conditions the Patch fitted Glass Door with double shutter, made of 12mm thick clear toughened glass, edge polished, toughened glass of Saint Gobain make as per the approved shop drawings. The glass shutters shall be supported on Dorma/Haffle/Sway make Heavy Duty patch fittings at top finished with brushed finished stainless covers and Dorma/Godrej/Savex make heavy duty Floor spring at the floor level at the approved shop drawings adhering to manufacturers specifications. This also includes providing necessary profiled cut-outs and enough numbers of machine made holes to facilitate fixing of patch fittings, handles, locks etc as per the hardware manufacturers specifications. All the edges of the glass panels including profiled cutting shall be neatly machine polished as per the manufacturer's specifications. This includes providing and fixing in position necessary stainless steel hardware like H-handles (40mm dia., 450mm long), patch lock etc. Dorma/Haffle, Sway make as per the approved shop drawings. This also includes providing necessary cut-out in the RCC floor slab, Granite/Marble floor adequate to fix the floor spring and finishing the same neatly after installation of floor spring as per the approved shop drawings. The mode of measurement for payment shall be based on the elevation area of the Doors. All glass panels to be have protective film coating till hand-over.The rate shall include providing of 20mm dia holes in the glass doors shutters as per the drawing. **Glass shall be of Saint Gobain/Ashai/ Atultuf/Arihant/Equivalent**	Sqm	20.00		-
					-
8	**<u>Aluminium Partly sliding & partly fixed portion:</u>** Providing and fixing Powder Coated aluminium glazed windows with Partly sliding and Partly fixed portion with two track sections fabricated as per drawing using aluminium extruded sections powder coated to the required finish as approved by the Architects and glazing with **8 mm thick Clear Toughned glass** of SGG/ASHAI/Atultuf or approved equivalent make, including providing and fixing all the fittings, handles, locking arrangements, etc.; complete as shown in the drawing. The quoted rate to include for providing approved color, shade and finish powder coating of minimum thickness 60 micron as per relevant IS specifications instead of natural anodizing. Aluminium sections shall be of Jindal/ Hindalco/Bhoruka.	Sqm	70.00		-
					-

9	**Extra for Aluminium Top Hung & Openable Windows :** Providing and fixing Powder coated Fabricated as per drawing using aluminium extruded sections powder coated to the required finish as approved by the Architects with all necessary Friction hinges, fittings, handles etc complete and glazing with **8mm thick Clear Toughned Glass** of SGG/ Ashai / Atultuf/Arihant/Equivalent, or any other approved make, complete as shown in the drawing. The quoted rate to include for providing approved color, shade and finish powder coating of minimum thickness 60 micron as per relevant IS specifications instead of natural anodizing. Aluminium sections shall be of Jindal/ Hindalco/Bhoruka	Sqm	3.00		-
	-				-
10	Providing & Fixing Aluminium extruded 'Z' louvers. Item shall include to provide powder coated flat as support and aluminium cleat at required spacing to form a shape and profile as per approved drawings and act as structural support to the louver capping.The support shall be designed and provided as per the approved structural calculations and drawings and the panel shall be fixed to the cleat ensuring the screws and fasteners shall not be visible on the external surface ..Aluminium sections shall be of Jindal/ HIndalco/Bhoraka at all levels(Powder Coating shade Code Shall be RAL 7005/Equivalent)	Sqm	150.00		-
					-
11	Providing and fixing of **Glass Canopy** made up of **12mm toughened glass** of Saint Gobain/Ashai/ Atultuf/Arihant/Equivalent fixed along with Aluminium subframe, Isolators, Rubber beading, flashing and Silicone sealant complete.,as per the drawings. The system is to be tested for water tightness and got approved from EIC. The rate shall be including for staging & scaffolding at all heights and levels with all necessary fittings/fixtures etc.,	Sqm	55.00		-
					-
12	**For Glass Canopy:** Providing straightening, fabricating and fixing in position structural steel work using MS rolled sections like angles, channels, flats, plates including checkered plates, rounds, RHS & SHS etc; including cutting, welding for Skylights including **sand blasting & Spray galvanising** with two coats of approved brand and color synthetic enamel paint over a coat of primer. Only standard weights as per IS code shall be considered for measurement and payment. **TISCO, SAIL, VIZAG,JSW** The rate shall be including for staging & scaffolding at all heights and levels	MT	2.00		-

13	Providing & fixing of moisure resistant **"ARMSTRONG PRIMA ADRIA / AEROLITE" True Horizontal Level False Ceiling with Grid** using hot dipped galvanised steel section exposed surface chemically cleaned capping pre-finished in baked polyster paint, main Tee of size 15x38x0.33mm at every 1200mm c/c max & rotary stitched cross "T" of size 15x38x0.254mm at every 600mm c/c maximum between main runners, 600mm cross Tee of size 15x38x0.254mm at every 1200mm centrally between 1200mm cross tees & 22x22x0.457mm wall angle alround wall to form a grid of size 600x600mm & suspended grid using suitable rigid hangers at every 1200mm intervals at main "T" & laying of size 600x600x15mm over frame grid. The false ceiling should be laid to pattern as shown in drg. Work should be as per manufacturer's specification.				
	NOTE: Cutouts for light fittings, grills, diffusers, etc have to be made with frame of perimeter channels of size 20x27 mmx30mm, 0.5mm thk supported suitably and should be included in the above rates and no extra rate will be paid for. Rate to include staging, scaffolding, etc. at all levels and heights.	Sqm	50.00		-
14	Providing & fixing of **Exterior Grade Aluminium Composite Panels (ACP) cladding for shaft covering** of 4mm thick covered with protective film as per the architect's selection with required MS Framework made of RHS/SHS of 3.6mm thk including anchor bolts, anchoring into RCC & masonry including grouting as per the site conditions as per the drawings. The panel shall be of approved make and approved metallic colour, powder coated to 40 micron of approved shade and colour (Prior approval of the colour shall be obtained before procurement) as per the pattern shown in the drawing, including fixing with necessary clamps, bolts, brackets, Silicone Sealant of GE / DOWCORNING make, removing the protective film upon erection etc., complete at all heights and levels. Vendor shall submit a fabrication drawing for approval of Architects before execution. The rate shall be including for staging & scaffolding at all heights and levels.The MS Framework shall be finished with 2 coats of synthethic enamel paint of approved brand & colour over a coat of primer.	Sqm	10.00		-
					-
15	Providing and fixing of external covering for exhaust and ancillary passive items. The above covering is made out of 50x25x1.5 Aluminium frame work using L angle cletes, self traping screws and anchor fastners.The external surface of the frame is cladded with 8mm thick acrylic glass along with vinyl. (Prior approval of the colour shall be obtained from the architects before procurement) as per the pattern shown in the drawing,	Sqm	16.00		-
	SUB TOTAL EXCLUDING GST				**-**

III	**FOR DEISEL FEEDING MECHANISM TO DG & STORAGE**				
1	Supply & Installation of 990 ltrsn HSD Tank	No	1.00		-
2	Supply & instatlation 0.5Hp Fuel Pump with including all Electrical Fixtrues	No	1.00		-
3	Supply & Installation of 25mm dia MS 'C" class pipe	Mts	30.00		-
					-
4	Supply and Fixing of 25mm dia valve	Mts	2.00		-
					-
5	Providing ,Fabricating and Fixing with Supporting steel for stand of 40 MM X 25 MM.	Kg	500.00		-
	SUB TOTAL EXCLUDING GST				**-**
IV	**for Level 5 Sunk Area**				
1	Providing and applying of two coats of Brushbond RFX of acrylic polymer modified cementitious waterproof coating with Food grade certification over prepared surface. Removing all surface laitance and contamination free from loose aggregate or other sharp protrusions with fairly smooth finish by wire brush and grinding method and surface shall be damped with Water for application of Brushbond RFX waterproof coating. Brushbond RFX shall contain a liquid polymer component and a cementitious powder component, which shall be mixed as per manufacturer's instructions and applied over prepared concrete surface strictly maintaining the coverage specified by the manufacturer. The applied material of Brushbond RFX should have a Pull off adhesion of greater than 1N/mm2 as per ASTM-D4541 and static crack accommodation of 1mm according to ASTM-C836. Complete as per the vendors methodology approved by consultants / clients. **all detail as per manufacturers specification M/s. Fosroc or Equivalent , Pedilite, BASF.**	Sqm	15.00		-
					-

2	Providing **15mm thick cement plaster** in single coat with cement mortar **1:3** to concrete surfaces including **providing and mixing water proofing compound manufactured from Bal Endura, Fosroc, Sika, BASF** at one Kg per bag or in the proportion recommended by the manufacturers rounding off corners wherever required, **finish as directed,** providing and removing scaffolding, including cost of all materials, labour, curing, HOM of equipments and machineries, leads and lifts at all levels, Loading and unloading charges, transportation cost and conveyance , all other incidental chargesetc., complete for successful completion of work all as per specifications and as directed by the Engineer-in-charge.	Sqm	15.00		-
					-
3	Supplying and placing of Non-load bearing of **Broken Light weight Aerocon Blocks** or any other approved equivalent placed as infill in slab/beams in roof. The blocks to be cut to required shape and size and placed in position with cement mortar packing for each blocksa complete as per drawings. (Wastage due to breakage to be accounted in the rates).	Cum	2.50		-
					-
4	Providing and laying 50 mm to 100mm thick **M15 grade concrete** with minimum cement content of 280kg/cum of 53 grade OPC using manufacture sand, 20mm and downsize aggregates for **sunken areas** including base preparation, compaction, curing, shuttering etc., complete at all levels as directed by Engineer in charge.	Cum	0.80		-
					-
5	Providing and laying of **PEBBLE TILES** of size upto 400x 400mm/600 x 600mm and **40mm thick** from Johnson Tiles or approved make, shade and size for **FLOORING and SKIRTING** of 100mm high laid on bed of 12mm thick cement mortar 1:3 mix, using combination of **PVC tile spacer** and Paper Joints, with flush pointing with white cement using colour pigment, including cost of all materials, labour, curing, complete HOM of equipments and machineries, all leads and lift, loading and unloading charges, transportation cost and conveyance, and all other incidental charges at all floor levels etc/ to cover the floor with POP on finished surface complete for successful completion of work as per drawings & specifications and as directed by the Engineer-in-charge**.**	Sqm	8.00		-
					-

6	Providing and laying **VITRIFIED TILES** of size upto 600x 600mm and 10mm thick of approved make, shade and size for **FLOORING and SKIRTING** of 100mm high laid on bed of 12mm thick cement mortar 1:3 mix, using combination of **PVC tile spacer 3 to 6mm thick**,and Paper Joints, with flush pointing with white cement using colour pigment, including cost of all materials, labour, curing, complete HOM of equipments and machineries, all leads and lift, loading and unloading charges, transportation cost and conveyance, and all other incidental charges at all floor levels etc/ to cover the floor with POP on finished surface complete for successful completion of work as per drawings & specifications and as directed by the Engineer-in-charge**.**	Sqm	50.00		-
7	Providing and applying water proofing for nito tile grouting/ Granite floor Grouting by cutting and opening the tiles using suitable machine making v grove , clean / remove the adhesive and debris from tile joint and cleaning the tile surfcae with damp sponge to remove dirt , dust , adhesive and stains . Apply nito tile GR and SBR thouroughly by mixing at the tiles joint gap and clean the surface after applying and applying epoxy putty cleaning the surface etc complete as directed by engineer in charge.	Sqm	150.00		-
	SUB TOTAL EXCLUDING GST				**-**
V	**False Ceiling for the Dining Area**				
1	Providing and Fixing seamless CEMENT BOARD 8mm thk fixed to the under side of the suspended grid formed of GI perimeter channel of size 20x27x30mm fixed along the wall by using wood screws & metal expansion rawl plugs. The GI intermediate channel of size 45x15x0.90mm shall be fixed to the suspended strap hanger /GI ceiling angle at intervals not more than 1220mm.The suspended GI ceiling angle/strap hanger is to be connected with GI soffit cleat of size 37x27x25, 1.6mm & it should be fixed on the steel beam and purlins by using metal expansion fasteners of 12.5mm dia. to the length of 35mm with screw at top ends, including all drops, coves etc jointing and taping & finishing. All the cement fibre board surfaces shall then be finished in proprietary make jointing compound as per the manufacturers specifications.Rate to be inclusive of cove and cutting for lights, grills/ ducts etc. The cement board surfaces shall then be finished with 2 coats putty and two coats primer and finally surface shall be painted with two coats of exterior grade premium emulsion paint as per architect's selection	Sqm	200.00		-
					-
2	Dismantling Existing Shera Board False Ceiling & Carting Away Debris outside the premises in places approved by the relevant local govt authorities at all Heights , levels, with necessary Stagging Scaffolding etc as per directions of Engineer-in-charge.	Sqm	200.00		-
					-

3	Providing and applying **Birla White wallcare putty-SF** or equivalent to **walls & Double Ht Ceiling** in two coats total thickness of the coats limited to a maximum of 1.5mm. The surface should be thoroughly cleaned of all loose material and shall be clean, free from dust, grease and loose material and shall be fully cured with clean water. Mixing and application of putty shall be as per manufacturers instructions. including preparing the surface, even and sand paper smooth, cost of materials, labour, HOM of equipments and machineries, including leads and lifts at all levels & Heights, Loading and unloading, transportation , all other incidental charges at all floor levels etc., complete all as per specifications and as directed by the Engineer-in-charge. No Extra cost shall be paid for double height areas. **(For double Ht Ceiling at level 04 & 05)**	Sqm	765.00		-
					-
4	**For Internal Walls & Ceiling:** Providing and applying painting in **two coats** with **PLASTIC EMULSION** Paint over a coat of primer of approved brand and shade to give an even approved shade after throughly brushing the surface, free from mortar drops and other foreign matter including preparing the surface even and sand paper smooth, including lead & Lift lift at all levels & heights, cost of materials, labour complete as per specification. The colour and shade shall be as per the architect's selection. **(For double Ht Ceiling at level 04 & 05)**	Sqm	765.00		-
	SUB TOTAL EXCLUDING GST				**-**
VI	**Roller Blinds at Level 06 Dining & Admin Area, Level 02 reception area**				
1	Supply & Installation of **Manual Roller Blinds** using **Sunscreen Fabric** of approved make. The size and shade of the fabric shall be as per the architect's drawings/approval.	Sqm	150.00		-
	SUB TOTAL EXCLUDING GST				-
VII	Road Works				
1	Providing & laying of **square paver blocks (shot blasted)** of size **100 x 100 mm, 65mm thk** set in 50 mm thick sand bed of "Basant Beton" or appvd make equivalent type of **Light Grey colour** as per manufacturer's specifications & as per drawings.	Sqm	500.00		-
					-
2	Providing & laying **square paver blocks (shot blasted)** of size **100 x 100 mm, 65mm thk** set in 50 mm thick sand bed of "Basant Beton" or appvd make equivalent type of **Dark Grey colour** as per manufacturer's specifications & as per drawings.	Sqm	215.00		-
					-

3	Providing & laying of **Rectangle Interlocking paver blocks (shot blasted)** of size **100 x 200 mm, 65mm thk** set in 50 mm thick sand bed of "Basant Beton" or appvd make equivalent type of **Light Grey colour** as per manufacturer's specifications & as per drawings.	Sqm	1,435.00		-
					-
4	Providing & fixing **RCC 1:2:4 Precast Curbs of Size 100x 400mm** each piece not less than 600mm long including Excavation inin all soils including hard soil, backfilling & consolidating with excavated earth & carting away the surplus earth away from site. Providing and placing Plain Cement Concrete M10 - 100 mm thick , Below Foundations for plugging Kerb stone etc, using coarse graded aggregates of 20 mm and down size, laid in layers and compacted by wooden or cast iron rammers including necessary shuttering , finishing, curing etc complete, fixing the Kerb stone to the required line, height and alignment & pointing joints with CM 1:3 to the required line and level.	Rmt	250.00		-
10	Earth work excavation by manual means for drains,canals, waste weir, draft, approach channels, key trenches, foundation of bridges and such simillar works in all kinds of soils , as per drawing and technical specifications, including setting out, shoring, strutting, barricading, caution lights, removal of stumps and other deleterious matter, excavated surface leveled and sides neatly dressed disposing off the excavated stuff or sorting & stacking the selected stuff for reuse in a radius of 50 m and lift upto 1.5 m including cost of labour, tools & other appurtenaces required to complete the work.	Cum	95.00		-
11	Providing and laying in position plain cement concrete for levelling course for all works in foundation. The granite/trap/basalt crushed graded coarse aggregates and fine aggregates as per relevant IS Codes machine mixed, laid in layers not exceeding 150 mm thickness, well compacted using plate vibrators, including all lead & lifts, cost of all materials of quality, labour, Usage charges of machineries, curing, and all the other appurtenances required to complete the work as per technical specifications.Mix 1:3:6 (M10) Using 20 mm nominal size graded crushed coarse aggregates	cum	5.00		-
12	Providing and constructing load bearing wall with Solid Concrete blocks of size 400x200x200mm having block density more than 1800kg/m3 and minimum compressive strength of 4.00 N/mm2 conforming to IS 2185 (Part - I) - 2005 and constructed with CM 1:4 as per IS 2572:2005 including cost of all materials, labour, scaffolding and curing, usage charges of machinery etc complete as per specifications.	Sqm	175.00		-
13	Providing 20 mm cement plaster of mix :1:4 (1 cement: 4 fine sand) to brick/stone masonary including rounding off corners wherever required smooth rendering, providing and removing scaffolding, including cost of materials, labour, curing complete as per specifications and as per directions of Engineer-in-charge	sqm	250.00		-

14	Providing and fixing Structural Steel work riveted, bolted or welded in built up sections, trusses and framed work, including cutting, hoisting, fixing in position and applying a priming coat of approved steel primer all complete including cost of materials, labour, usage charges of machinery complete as per specifications and as per directions of the Engineer-in-Charge.	Kg	2,500.00		-
	SUB TOTAL EXCLUDING GST				**-**

M/s. INDIAN INSTITUTE OF MANAGEMENT, BANGALORE

Bill of Quantities for Proposed Additional & Modifications Works to Existing MDC Block @ Survey No 47, Mahanthalingapura Village, Jigani Hobli Anekal Taluk, Bengaluru urban district.

Part B: Electrical Works for MDC Block @ IIMB New Campus Survry No 47, Mahantalingapura, Jigani Hobli, Anekal Taluk ,Bengaluru

Sl.No.	Description	Unit	Qty	Rate	Amount
				in Rs.	in Rs.
I	**INTERNAL ELECTRIFICATION**				
1	Supplying and fixing suitable size GI /PVC box with modular plate and cover in front on surface or in recess, including providing and fixing modular switch with front plate, connections etc. as required.				
1.1	Light point controlled by one 6A switch.	NOS	48.00		-
2	Wiring for circuit/ submain wiring along with earth wire with the following sizes of FRLS PVC insulated copper conductor, single core cable in surface/ recessed medium class PVC conduit as required				
2.1	2 X 1.5 sq. mm + 1 X 1.5 sq. mm earth wire	RMT	25.00		-
2.2	2 X 2.5 sq. mm + 1 X 2.5 sq. mm earth wire	RMT	76.00		-
3	For Level 06 - common toilet: Supply, Installation, testing and Commissioning of Exhaust fans of following size sweep with gravity louvers shutters including all accessories / Installation materials required. 305mmsize sweep Exhaust fan with gravity louvers shutters including all accessories / Installation materials required -1 set(1 No) Colour shall be as per architect's selection.	No's	2.00		-
	SUB TOTAL EXCLUDING GST				-
II	**Street lighting**				

	AREA LIGHTING				
AL-1	Supply, erection and commissioning of individual 5mtr (600mm below Ground) high 50mm dia Class B GI pole, with base plate, FRP terminal box, wiring from terminal box to the fixture with 3core 2.5Sq.mm multistrand Copper conductor cable, MCB control and 2nos of 40mm dia class B GI pipe for incoming and outgoing cables etc including PCC foundations, pedestal and Supply and installation of 30W LED Lamp Post top Lantern fixture Integral type with Lamp and Controlgear/driver. **Make : Jaguar Warm white street li9ght lighting - 70W JQM-GRY-LSRT015070XW or equivalent**	Nos	26.00		-
AL-2	Supply, testing & commisioning of following size 1.1KV grade XLPE insulated armoured aluminium conductor cable.The cable shall conform to IS 7098/ Part I.				
2.1	4Core 10 sq.mm	RM	150.00		-
2.2	4Core 6 sq.mm	RM	300.00		-
AL-3	Laying of one number PVC insulated and PVC sheathed I XLPE power cable of 1.1 kV grade of following size direct in ground including excavation, sand cushioning, protective covering and refilling the trench etc. as required.				
3.1	Up to 35Sq.mm	RM	400.00		-
AL-4	Laying of one number PVC insulated and PVC sheathed / XLPE power cable of 1.1 kV grade of following size in the existing RCC/ HUMEI METAL pipe as required.				
4.1	Upto 35 sq. mm	RM	50.00		-
AL-5	Supplying and fixing cable route marker with 10 cm X 10 cm X 5 mm thick G.I. plate with inscription there on, bolted /welded to 35 mm X 35 mm X 6 mm angle iron, 60 cm long and fixing the same in ground as required.	Nos	5.00		-
AL-6	Supplying and making end termination with brass double compression gland(Heavy) and aluminium lugs for following size of PVC insulated and PVC sheathed I XLPE aluminium conductor cable of 1.1 kV grade as required.				
6.1	4Core 10 sq.mm	Nos	4.00		-
6.2	4Core 6 sq.mm	Nos	52.00		-

AL-7	Providing Spiral coil earthing with 8 SWG GI wire including spreading of salt and charcoal as per IS 3043/87 with latest amendments.	Nos	26.00		-
AL-8	Supplying & Fixing chimical earthing for grouting conduits IC Cutouts & other equipments backfilling compound which is non corrosive ,themrnally condutcive , potential to permissible limits ,super faculties conduction capacity , non toxic, weather resistance & capacity of achieving ohmic values less than one oHM inclusding excavation, precast chamber size of 400 mm X 400 mm supply & installation , other all necessary condiuts ss hardware etc.	Nos	4.00		-
AL-9	Supply and laying of following dia. NP2 grade RCC hume pipes with collars for road crossings, laid 750mm below ground level including excavation, back filling etc., complete.				
9.1	150mm dia.	RM	10.00		-
AL-10	Liasioning work for additional load with BESCOM	job	1.00		-
AL-11	Cable laying by trench less means - Moling . The cable has to be laid at a dept of 2 Mtr without disturbing existing lines	Rmt	150.00		-
	SUB TOTAL EXCLUDING GST				-

M/s. INDIAN INSTITUTE OF MANAGEMENT, BANGALORE							
Bill of Quantities for Proposed Additional & Modifications Works to Existing MDC Block @ Survey No 47, Mahanthalingapura Village, Jigani Hobli Anekal Taluk, Bengaluru urban district.							
Part C: Supply , Installation , Testing and Commissioning of HVAC Works for MDC Block @ IIMB New Campus Survry No 47, Mahantalingapura, Jigani Hobli, Anekal Taluk ,Bengaluru							
				Supply		**Installation**	
Sl.No.	**Description**	**Unit**	**Qty**	**Rate**	**Amount**	**Rate**	**Amount**
				in Rs.	in Rs.	in Rs.	in Rs.
a	**VRF SYSTEM**						
	Supply, installation, testing and commissioning of Variable Refrigerant Volume Modular type air-conditioning system with wide range of indoor and outdoor units, with longer actual and total piping length and with high external static pressure. The system consists of multiple indoor units ranging from high wall, fan coil, ducted type, floor mounted type packaged unit etc. Connected to a single or multiple modular type outdoor units with individual controllers to each indoor unit, starting controls, safety controls, operating controls and with full feature microcomputer based controller with real time clock and programming, refrigerant piping, control cabling and also centralized controller. The unit is to be given a complete factory operating and control sequence test under load conditions with fluid hooked up, and is to be shipped with full operating charge of refrigerant and oil. Air-cooled Condensor, first charge of refrigerant etc. The specifications and details are as below:						
	MAKE: LG / Samsung / Daikin / Thoshiba / Mitsubishi / Blue Star / Voltas						
	OUTDOOR UNIT						
1	Supply of Variable Refrigerant Volume outdoor units comprising of multiple high COP scroll compressors (minimum Two/Three per outdoor unit with all are on invertor drive), low noise propellor type aero spiral fan,Condenser coil with special acrylic pretreatment for improved resistance to corrosion,refrigerant shut off valves,safety devices, lead free PC boards suitable for operation on R410a.and on 415 V+/- 10%, 50 Hz, 3 phase A/C supply. as per specifications;(INVERTOR TYPE ONLY shall be acceptable) Suitable power cabling from breaker / isolator to outdoor units (2 mts long) is in HVAC contractor scope						

	Capacities indicated are actual operating for **BANGALORE** outdoor condition and for room temp of **24** deg C ± **1**deg C with **55%** RH						
	Note:- vendors has to take approval from the Architects / consultants prior to manufacture of units. Also site visit to be done before manufacturing.						
a	18 HP	Nos.	1.00		-		-
	INDOOR UNITS						
	CEILING MOUNTED CASSETTE TYPE						
2	Supply, Installation, Testing and commissioning of Ceiling mounted Cassette (4 way) type indoor units with 360º airflow for uniform temperature distribution, 3-step control turbo fan with whisper quietness, compact cooling coil, electronic expansion valve, suction air grill, in built drain pump coated with silver ions to prevent slime, mould and bacterial growth, air filter with anti-mould and anti bacterial treatment & decorative panel with dirt repellant coating. Suitable Power cabling with 15AMPS plug socket (2 mts long) for all indoor units in HVAC contractor scope.						
	Note:- vendors has to take approval from the Architects / consultants prior to manufacture of units. Also site visit to be done before manufacturing.						
a	1.5 TR / 455 CFM	Nos.	10.00		-		-
3	**CENTRAL CONTROLLER FOR 16 INDOOR UNIT**						
	Supply, installing, testing and commissioning of Intelligent master Controller icon based, the system must be having following feature - colour LCD touch panel icon display, multi language (English), yearly schedule, auto heat/cool change over, temperature set up , enhanced history function, interlock function the system must be capable of connecting 100 groups Indoor units. etc., complete The master controller must be capable of communicating to all ODUs & IDUs, with a override facility, on/off, monitoring etc.. Furnish the detailed action/activity list of master controller. NOTE:(Installation of I Touch Controller only with BMS & linked with PC)	Nos	1.00		-		-
	SUB TOTAL FOR VRF UNITS				**-**		**-**

b	**REFRIGERENT PIPING & ASSOCIATED WORKS**						
1	**Supply, Installation, testing** of hard drawn Copper Piping insulated with xlpe tubular insulation of 19 / 13 mm thick with necessary **fitting arrangements, Refrigerant pipe fittings, Y-Joints / Ref net Joints etc and Remote with topping up of R410A gas**. All piping inside the room shall be properly supported with hanger etc., complete						
	Note: Supply "Y-Joints and Ref net Joints" along with Copper Pipe (size of the **"Y-Joints and Ref net Joints"** should be done by the equipment suplier based on their piping sizing software)						
a	34.9 mm with 19 mm thick insulation	Rmt	RO				
b	31.8 mm with 19 mm thick insulation	Rmt	RO				
c	28.6 mm with 19mm thick insulation	Rmt	40.00		-		-
d	25.4 mm with 19mm thick insulation	Rmt	RO				
e	22.2 mm with 13 mm thick insulation	Rmt	3.00		-		-
f	19.1 mm with 13 mm thick insulation	Rmt	2.00		-		-
g	15.9 mm with 13 mm thick insulation	Rmt	40.00		-		-
h	12.7 mm with 13 mm thick insulation	Rmt	23.00		-		-
i	9.5 mm with 13 mm thick insulation	Rmt	7.00		-		-
j	6.4 mm with 13 mm thick insulation	Rmt	20.00		-		-
2	**CONNECTION TO INDOOR UNIT (Flare Connection)**						
a	28.6mm with 13 mm thick tubular insulation (Brazing)	Rmt	1.00		-		-
b	19.1 mm with 13 mm thick tubular insulation (Brazing)	Rmt	RO				
c	15.9 mm with 10 mm thick tubular insulation (Brazing)	Rmt	1.00		-		-
d	12.7 mm with 10 mm thick tubular insulation	Rmt	10.00		-		-
e	9.5 mm with 8 mm thick tubular insulation	Rmt	RO				
f	6.4 mm with 8 mm thick tubular insulation	Rmt	10.00		-		-
	Y-JOINTS / Ref net Joints						
3	**Supply, Installation of Y-Joints / Ref net Joints and sizing** should be done by the equipment suplier based on their piping sizing software.	NoS	9.00		-		-
	DRAIN PIPING						

4	Supply, Installation and testing of PVC - blue piping complete with fittings, supports as per specifications and insulated with 9 mm thick xlpe / nitrile rubber insulation with protective coating etc., pipe shell be roughted nearest drain point, drain point should be others scope						
a	32 mm dia	Rmt	30.00		-		-
b	25 mm dia	Rmt	13.00		-		-
5	**Transmission & Control Wiring**						
a	Supply & laying of control cum transmission cable with conduit, cabling between Indoor and outdoor units in PVC conduit (2 core 1.5 sq.mm).	Lot	1.00		-		-
b	Supply of cordless remote for indoor units with necessary control wiring receiver kit (for Cassette Unit)	No.	10.00		-		-
	SUB TOTAL FOR REFRIGERENT PIPING & ASSOCIATED WORKS				**-**		**-**
c	**VENTILATION SYSTEM**						
	INLINE TYPE EXHAUST FAN						
4	Supplying, installing, testing and commissioning of INLINE FANS suitable for installing in any position in vertical or horizontal ducts. The casing shall be double skin, internally acoustically lined and constructed of galvanised steel. The fan shall be DIDW with forward curve impeller fitted with maintenance free external rotor motor. The motor shall be suitable for 220±10% volt single phase 50 cycles AC supply & power cabling with 3 pin plug top Etc. with necessary hanging arragement Bracket . The fan shall have low sound level exceeding not more than 50 dBA at three meter distance.						
a	Toilet Exhaust- 280 CFM Capacity Exhaust air unit	Nos	1.00		-		-
	SUB TOTAL FOR VENTILATION SYSTEM				**-**		**-**
d	**AIR DISTRIBUTION WORKS**						
	Supply, Installation, Testing & Commissioning & Handing over of the following:						
	DUCTING						
	DUCTING WORKS AS PER IS STANDARDS WITH ALL SIZES MADE OF ANGLE IRON FLANGE JOINTS AS SPECIFIED IN SPEC.						

1	Sheet Metal Work using Angle Iron Flanges for all sizes of the duct using Lock Former Machine. Fabrication as per IS Standards vide attached technical specification. Galvanizing shall be Class VII – light coating of zinc, nominal 120 gm / sqm surface area and Lock Forming Quality prime material along with mill test certificates. In addition, if deemed necessary, samples of raw material, selected at random by owner's site representative shall be subject to approval and tested for thickness and zinc coating at contractor's expense. The Duct shall be supported with Hi-tech Supports at regular intervals as mentioned in the technical specifications.						
a	24 G (0.63 mm) GI ducting	Sqmt.	26.00		-		-
b	22 G (0.80 mm) GI ducting	Sqmt.	RO				
c	20 G (1.00 mm) GI ducting	Sqmt.	RO				
d	18 G (1.30 mm) GI ducting	Sqmt.	RO				
	EXHAUST & FRESH AIR LOUVER						
2	Supply and installation of Exhaust & Fresh Air wall / door Louver	Sqm.	1.00		-		-
	TOILET EXHAUST GRILLE						
3	Powder coated, extruded aluminium Exhaust air grille with volume control dampers for Toilets						
	150 x 150 mm EAG for Toilets	Nos.	7.00		-		-
	BACK DRAFT DAMPER WITH GSS COWL FOR EXHAUST FAN						
4	Back Draft Dampers made out of 22/ 20 ** G GSS sheet with circular GI blades to control one side air flow from main duct to exhaust fan / louvers. The blade shall have rubber gasket beeding for air tightness.						
	250X250	Nos.	1.00		-		-
	SUB TOTAL FOR AIR DISTRIBUTION WORKS				**-**		**-**
	INTERNAL ELECTRIFICATION						
1	Supplying and fixing suitable size GI box with modular plate and cover in front on surface or in recess, including providing and fixing 3 pin 5/6 A modular socket outlet and 5/6 A modular switch, connections etc. as required.	NOS	15.00		-		-

							-
2	Wiring for circuit/ submain wiring along with earth wire with the following sizes of FRLS PVC insulated copper conductor, single core cable in surface/ recessed medium class PVC conduit as required						-
							-
2.1	2 X 2.5 sq. mm + 1 X 2.5 sq. mm earth wire	RMT	150.00		-		-
							-
2.2	4 X 10 sq. mm + 2 X 10 sq. mm earth wire	RM	30.00		-		-
							-
3	Supply Installation Testing and commissioning of TPN MCB Double door Distribution boards dust and vermin protected and rated for 415V Three Phase AC supply operation including incoming MCB /ELCB as per specifications and required capacity Neutral bar and Earth terminal complete as required and installed in concealed in wall after necessary chase cutting with finishing/surface in wall including all fixing materials required. MCBs shall conform to IS : 8828 and ELCB shall conform to IS :12640. All MCBs shall be 'C' Curve. DBs shall be provided along with required wire adopter boxes around the DB as required and dummys for spare ways in the DB (No claim shall be allowed for the same).						-
3.1	4Way TPNMCBDB with 40A, 100mA 4Pole RCBO as incomer and 12 nos 6-25A SPMCBs as outgoings. (LDBs)	Each	1.00		-		-
							-
3.2	40A 100mA RCCB with enclosure	Each	1.00		-		-
4	Supply of MV Cables						
	Supply ,testing and commisssion of following size 1.1KV grade XLPE insulated armoured aluminium conductor cables . The cable shall conform to IS 7098/ Part I.						
4.1	4C X 16 sq.mm Aluminium	RM	80.00		-		-
							-
							-
5	Laying and fixing of one number PVC insulated and PVC sheathed I XLPE power cable of 1.1 kV grade of following size on cable tray/trench as required.						-
							-
5.1	Up to 35Sq.mm	RM	80.00		-		-
							-

6	End Terminations						-
	Supplying and making end termination with brass compression gland and aluminium lugs for following size of PVC insulated and PVC sheathed/ XLPE aluminium conductor cable of 1.1 kV grade as required.						-
6.1	4C X 16 sq.mm Aluminium	Each	2.00		-		-
							-
							-
7	Supply and laying of following size earth strips including all fixing accessories when laid in trench/Tray with necessary interconnections with earth station and equipments.						-
							-
7.1	25 X 5mm GI strip	RM	30.00		-		-
	SUB TOTAL FOR INTERNAL ELECTRIFICATION				-		-
VI	**Load Bifurcation of HVAC** Panel						
1	Supply and Laying of following 11KV grade 3Core Stranded Aluminium Conductor XLPE insulated PVC bedded galvanized flat steel / strip armoured and PVC over all sheathed screened cable confirming to IS 7098 part-II (with latest amendments) laid in ground 1000mm below ground level including excavation, back filling, cable covered with side and top by baked bricks, RCC Tiles or in RCC Hume Pipe already provided for Road crossing in a Built up Trench on MS Angle Supports complete as required. Cable Markers as per Typical Drawing 11KV 3 core 95 sqmm XLPE UG cable	Mtr	20.00		-		-
					-		-
2	Straight through joint a)11KV 3 core 95 sqmm	Nos	1.00		-		-
					-		-
3	Supply and Laying of 1.1KV grade XLPE insulated PVC overall sheathed stranded AL conductor flat steel strip/wire armoured cables confirming to relevant IS Specifications with latest amendments & of following sizes laid in ground 750mm below Ground level including excavation and back filling cables covered with side and top by baked bricks or in Hume Pipes already embeded in ground for Road crossing/ In Built up Trench on Steel Supports complete as required31/2 C 95 sqmm XLPE UG Cable	Mtr	300.00		-		-

4	Supply and providing of following cable end terminations with all accessories such as Brass gland, Aluminium Lugs suitable for Crimpinwg,Cable end box complete as required.						
	31/2 C 95 sqmm XLPE UG Cable						
		Nos	2.00		-		-
5	VTPN DB (OUTDOOR TYPE)						
	Incoming						
	1Nos. 200A 415V 35KA 4PMCCB						
	Bus bar						
	200A 415V TPN+E Al. Bus bar	SET	1.00		-		-
	Outgoings				-		-
	63A 415V 10KA TPN MCB				-		-
	3Nos				-		-
	40A 415V 10KA TPN MCB				-		-
	2Nos				-		-
	SUB TOTAL FOR INTERNAL ELECTRIFICATION				-		-

	SUMMARY						
I	VRF UNITS				-		-
II	REFRIGERENT PIPING & ASSOCIATED WORKS				-		-
III	VENTILATION SYSTEM				-		-
IV	AIR DISTRIBUTION WORKS				-		-
V	INTERNAL ELECTRIFICATION				-		-
VI	Load Bifurcation of HVAC Panel				-		-
	TOTAL FOR SUPPLY & INSTALLATION WORKS				-		-

	Sub Total for VRF for AC Materials				-		
	SUB TOTAL EXCLUDING GST				**-**		
	TOTAL Cost EXCLUDING GST				**-**		