

STANDARD BIDDING DOCUMENT

PROCUREMENT OF

BUILDING WORKS

N.O.W. :- New construction of PHC Main Building, PM Room, Compound Wall, C.C. Road and Electrical Work at Fulay, Ta:-Nakhatrana, Dist:-Kutch.

COMPLETE BIDDING DOCUMENT

**PROJECT IMPLEMENTATION UNIT
HEALTH & FAMILY WELFARE DEPARTMENT**



**GOVERNMENT OF GUJARAT
HEALTH & FAMILY WELFARE DEPARTMENT
GANDHINAGAR**

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**INVITATION FOR BID
(IFB)**

NATIONAL COMPETITIVE BIDDING

1. The Superintending engineer, PIU, Zone- 1, Dist. Kutch invites bids for the construction of works detailed in the table.

The bidders may submit bids for any or all of the following works.

TABLE

Package No.	:	ID No:-
Name of work	:	New construction of PHC Main Building, PM Room, Compound Wall, C.C. Road and Electrical Work at Fulay, Ta:-Nakhatrana, Dist:-Kutch.
Approximate value of works(Rs.)	:	Rs. 1,71,01,971.74
Tender Fee(Rs.)	:	Rs. 3600.00
Bid security EMD(Rs.)	:	Rs. 1,71,100.00
Period of completion	:	09 (Nine) Months
Class of Registration/ Category of contractor if required	:	"B" Class (Special Category Building III) and Above from Gujarat State R&B Depts or similar Government Dept of Government of Gujarat only.

2. Prospective / Interested bidder may download the Bid Documents from website <https://www.nprocure.com> free of cost till the Time and Date as mentioned on online NIT at website <https://www.nprocure.com>.

3. However, Bidder who is submitting the Bid Online will have to pay the Bid Document Fee / Tender Fee through Demand Draft only of any Schedule Bank payable at Gandhinagar and in favor of '**PIU GENERAL FUND A/C 11-114**'. Once the Bid is received online, Bid Document / Tender Fee will not be refundable.

The Demand Draft for Bid Document / Tender fee and FDR / Bank Guarantee against Bid Security / EMD shall be submitted in electronic format through online (by scanning) while uploading the bid, this submission shall mean that bid document / tender fee and Bid Security / EMD has been received. Accordingly, the offer of only those shall be opened whose Bid Document / Tender Fee and Bid Security / EMD have been received electronically. However, for the purpose of realization of Demand Draft, and FDR / Bank Guarantee bidder shall send the same in original through R.P.A.D. so as to reach to 'Superintending engineer, Gandhinagar within 7 Days from the last day of bid submission.

Penaltative action for not submitting Demand Draft / FDR / Bank Guarantee in original to Superintending engineer / Tender Inviting Authority, PIU by bidder shall be initiated.

4. Bids received online, will be opened on the time, date and place as specified in the online NIT at website <https://www.tender.nprocure.com> in the presence of the bidders or their authorized representatives, who wish to remain present.

If the office happens to be closed on the day of opening of the bids as specified, the bids will be opened on the next working day at the same time and venue.

5. ~~A pre bid meeting will be held onathrs. at the office of Superintending engineer at Gandhinagar to clarify the issues and to answer questions on any matter thatmay be raised at that stage as stated in clause 9.2 of 'instructions to Bidders' of the bidding documents.~~

6. Bid Security (EMD) is equal to 1% of Estimated Amount put to bid / tender and should be rounded off to the next thousand rupees.

7. Other Information is as under:

A. Agencies can prepare and edit their offers a number of times before the end of the tender submission date and time. After the tender submission date and time, the bidder cannot modify / edit / withdraw their submitted offer in any case. No written or online request in this regard shall be granted.

- B. Offers in physical form will not be accepted in any case.
- C. Demand Draft purchased by the other then bidder and issued after the last date of submission of Bids, will not be considered or accepted.
- D. The cost incurred by the contractor for this offer for clarification or attending discussion, conferences or site visits will not be reimbursed by the Employer or Engineer-in-Charge.
- E. Conditional tender shall not be accepted.
- F. Any changes, addition, alternation made in the prescribed form attached with tender are liable to be rejected.
- G. Any change in format or conditional Bank Guarantee will not be accepted and the bidder will be considered non-responsive.
- H. All the bidders are instructed to fill in information strictly in accordance with the format given in the checklist /qualification document / tender document.
- I. It is mandatory for the bidders to supply each and every information as asked strictly in electronic format at appropriate places only.
- J. Blank / insufficient information shall be treated as nil information and shall result in disqualification.
- K. Even if the bidder has been qualified in a similar or larger size of project in the past, it shall not be deemed to be a ground / reason for not giving required information for this work /bid.
- L. Information supplied for earlier projects shall not be considered while evaluation of this bid. The Government will not ask for any other information, unless it is found absolutely necessary by the competent authority.
- M. If found necessary, the contractor will be intimated for negotiation,

For the works costing up to 7.5 crore (ROAD), 7.0 crore (BUILDING & BRIDGE) kindly refer to SSR-10-2015-17-C dated 03-02-2017

For the works costing under 7.5 crore for Road Works and 7.0 crore for Building and Bridge Works following documents shall be submitted in electronic format only through online by scanning and the (i) Bid Document Fee / Tender Fee (ii) Bid Security / EMD should be sent in original to the Tender opening authority through RPAD, so as to reach the Superintending Engineer within 7 days from last day of submission of Bid.

- (i) Bid Document Fee / Tender Fee **(From Bidders A/C Only)**
- (ii) Bid Security / EMD or Valid EMD Exemption Certificate of Appropriate Class of Registration of Approved Contractors
- (iii) Registration Certificate of Appropriate Class
- (iv) Registration Certificate of Special Category - Building
- (v) GST Number & PAN Number
- (vi) Work Experience, if necessary...
- (vii) Solvency Certificate (for current calendar year)
- (viii) A solvency certificate of an Amount of 20% (Twenty Percent) of estimated cost put to tender will have to be produced along with tender. It shall be of Scheduled Bank or Nationalized Bank or Bank Approved for Government business. Solvency Certificate shall have validity of same calendar year as that of date in which tender is issued
- (ix) EPF Registration Number & ESIC Registration Number
- (x) Other Documents, as required...


Dy. Executive Engineer
Project Implementation Unit
Bhuj - Kutch


Executive Engineer
Project Implementation Unit
Bhuj - Kutch

SECTION - 1
INSTRUCTIONS TO BIDDERS
(ITB)

Section 1: Instructions to Bidders

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A. GENERAL

1. Scope of Bid

- 1.1 The Project Implementation Unit, Family Welfare Department, Government of Gujarat invites bids for the Construction of works(as defined in these documents and referred to as ‘the works’) detailed in the table given in IFB. The bidders may submit bids for any or all of the works detailed in the table given in IFB.

The Project Implementation Unit, Family Welfare Department, Government of Gujarat, **New construction of PHC Main Building, PM Room, Compound Wall, C.C. Road and Electrical Work at Fulay, Ta:-Nakhatrana, Dist:-Kutch.**

The successful bidder will be expected to complete the works by the intended completion date specified in the Contract data.

- 1.2 Throughout these bidding documents, the terms ‘bid’ and ‘tender’ and their derivatives (bidder/ tenderer, bid / tender, bidding/ tendering, etc.) are synonymous.

2. Source of Funds

- 2.1 The expenditure on this project will be met from the budget of Govt. of Gujarat / Govt. of India for centrally sponsored projects.

3. Eligible Bidders

- 3.1 This Invitation for Bids is open to all eligible bidders.
- 3.2 All bidders shall provide in Section 2, Forms of Bid and Qualification Information, a statement that the Bidder is neither associated, nor has been associated, directly or indirectly, with the consultant or any other entity that has prepared the design, specifications, and other documents for the Project or being proposed as Project Manager for the Contract. A firm that has been engaged by the Employer to provide consulting services for the preparation or supervision of the works, and any of its affiliates, shall not be eligible to bid.

4. Qualification of the Bidder

- 4.1 All bidders shall provide in Section 2, Forms of Bid and Qualification Information, a preliminary description of the proposed work method and schedule, including drawings and charts, as necessary. The proposed methodology should include a program of construction backed with equipment planning and deployment duly supported with broad calculations and quality assurance procedures proposed to be adopted justifying their capability of execution and completion of work as per technical specifications, within stipulated period of completion.

4.2 Deleted

4.3 Deleted

4.4 Deleted

#4.5 QUALIFICATION CRITERIA:

(Applicable for the works which require Post Qualification)

- 4.5.1 Qualification will be based on Applicant’s meeting all the following minimum pass/fail criteria regarding the Applicant’s general and particular experience, personnel and equipment capabilities and financial positions, as demonstrated by the applicant’s responses in the forms attached to the letter of application (specified

requirement for joint ventures are given under para 4.6 below) Subcontractors experience and resources shall not be taken in to account in determining the applicants compliance with the qualifying criteria

To qualify for more than one contract, the applicant must demonstrate having experience and resources sufficient to meet the aggregate of the qualification criteria for each contract given in paragraphs 4.5.4, 4.5.5 and 4.5.9 below

~~4.5.2—Base year and Escalation~~

The base year shall be taken as Current financial year

Following enhancement factors will be used for the costs of works executed and the financial figure to a common base value for works completed in India.

<u>Year</u>	<u>Financial Year</u>	<u>Multiplying factor</u>
Base year of inviting tender	2023-24	1.00
-1	2022-23	1.10
-2	2021-22	1.21
-3	2020-21	1.33
-4	2019-20	1.46
-5	2018-19	1.61

Applicant should indicate actual figures of costs and amount for the works executed by them without accounting for the above-mentioned factors.

In case the financial figures and value of completed works are in foreign currency the above enhanced multiplying factors will not be applied. Instead, the current market exchange rate (State Bank of India BC Selling rate as on the last date of submission of the bid) will be applied for the purpose of conversion of the amount in foreign currency into India rupees.

~~4.5.3. General Experience.~~

The Applicant shall meet with the following minimum criteria:

~~(a) —Annual Turn Over—~~

Achieved a minimum annual financial turnover (defined as billing for works in progress and completed in all classes of civil engineering construction works-only) in any one year, over the last five years of the annual value of contract /- contracts applied for.

**Annual Turn Over shall be more than Rs. _____ Crore (i.e. X)-
(for guidance of deriving X the value of X shall be derived by dividing amount put to tender by the time limit expressed in years for the project /-work.)**

Joint Venture: Lead Partner & Second another Partner only (i.e. 1(Lead Partner)+1(Other Partner)

~~For Joint Venture: The Lead Partner must have updated annual turnover not less than Rs. _____ Crores. (51% of X) & remaining Partner must have updated annual turn over not less than Rs. _____ Crores. (30% of X)-~~

~~The Joint Venture must collectively have updated annual turnover not less than Rs. _____ Crores. (i.e. X)~~

(b) Successful Experience

~~Experience in successfully completing or substantially completing at least one contract of similar nature of building works of at least 40 percent of the value of proposed contract within the last five years.~~

~~The works may have been executed by the applicant as prime contractor or as a member of a joint venture or as a nominated sub-contractor. As subcontractor, he should have acquired the experience of execution of all major items of works under the proposed contract. In case a project has been executed by a joint venture, weight towards experience of the project would be given to each joint venture in proportion to their financial participation in the joint venture.~~

~~Substantially completed works means those works which are at least 90 % completed as on the date of submission (i.e. gross value of work done up to the last date of submission is 90 % or more of the original contract price) and continuing satisfactorily.~~

~~For these, a certificate from the employers shall be submitted along with the application incorporating clearly the name of the work, contract value, billing amount, date of commencement of works, satisfactory performance of the contractor and any other relevant information. (as attached Form – 3A)~~

~~Bidder must have as prime contractor or as nominated (Approved by Employer) Sub Contractor successful Experience as follows:~~

- ~~I. At least One similar work having updated completion cost not less than Rs. _____ Crores. (40 % of the Amount put to tender of the proposed work).~~
- ~~II. Such Work must have been completed/ substantially completed (i.e. gross value of work done up to the last date of submission is 90 % or more of the original contract price) within last 5 financial years i.e. from 01/04/____ till the due date of bid for the proposed work.~~
- ~~III. A work would qualify as similar work only if it meets with definition given in Appendix – A.~~
- ~~IV. For updating completion cost of the work to the current financial year procedure narrated in Cl.4.5.2 and Appendix 2 ITB Section 1, Sr. No.18 itself mutatis mutandis apply.~~
- ~~V. For Joint Venture, qualifying threshold amount of updated completion cost would be as per GR No. SSR/10/2015/17/C Dt. 20-06-2020 of Sr. No. 2(b) V or as mention here under:
(V-I) Lead Member: Rs. _____ Crores (75% of amount mention in (b) I. i.e. 30% of amount put to tender)
(V II) Other Member: Rs. _____ Crores (51% of amount mention in (b) I. i.e. 20.4% of amount put to tender)~~

4.5.4. Personnel Capabilities.

~~Availability for his work of personnel with adequate experience as required; as per~~

Appendix.

4.5.5. Equipment Capabilities

~~Based on the studies carried out by the Engineer, the minimum suggested major equipment to attain the completion of works in accordance with the prescribed construction schedule are shown in the Appendix.~~

~~The bidders should, however, undertake their own studies and furnish with their bid, a detailed construction planning and methodology supported with layout and necessary drawings and calculations to allow the employer to review their proposals. The numbers, types and capacities of each plant/equipment shall be shown in the proposals along with the cycle time for each operation for the given production capacity to match the requirements.~~

4.5.6. Financial Position

~~The Applicant should give undertaking that he has access to, or has available, liquid assets (aggregate of working capital, cash in hand and uncommitted bank guarantees) and / or credit facilities up to 25 percent of the value of the contract / contracts applied.~~

~~4.5.7. The audited balance sheets for the last five years should be submitted, which must demonstrate the soundness of the applicant's financial position, showing long term profitability including an estimated financial projection for the next two years, if necessary, the employer will make inquiries with the applicant's bankers.~~

4.5.8. Litigation History

The Applicant should provide accurate information on any litigation or arbitration resulting from contracts completed or under execution by him over the last five years. A consistent history of awards against the Applicant or any partner of a joint venture may result in failure of the applicant.

4.5.9. Disqualification

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

Made misleading or false representation in the forms, statements submitted, and / or Record of poor performance such as abandoning the work, rescinding of contract for which the reasons are attributable to the non – performance of the contractor; consistent history of litigation awarded against the applicant or financial failure due to bankruptcy. The rescinding of contract of a joint venture on account of reasons other than non – performance, such as Most Experienced partner of joint venture pulling out, court directions leading to breaking up of a joint venture before the start of work, which are not attributable to the poor performance of the contractor will, however, not affect the qualification of the individual partners.

**#4.6 JOINT VENTURE: (Maximum 2 Members i.e. 1 Lead & 1 Others)-
(Applicable only for estimated project cost of 50 Crore and above)**

4.6.1.—Joint ventures must comply with the following requirement:

(a)—Following are the minimum qualification requirements:

(i)—The lead partners shall meet not less than 51 percent of all criteria given in para

~~4.5.3~~ (a) Annual Turn Over 4.5.3 (b) Successful Experience V-I & 4.5.6 above.

The joint venture must collectively satisfy the criteria of para 4.5.3 & 4.5.6 above. The experience of the other joint venture partners shall be considered if it is not less than 30 percent of the qualifying criteria in para 4.5.3 & 4.5.6 above.

(ii)—Individually each member must satisfy the requirements of para 4.5.3(a), 4.5.3.(b), 4.5.7, 4.5.8 above and 4.7 below.

(b)—Bid shall be signed so as to legally bind all partners, jointly and severally, and shall be submitted with a copy of the joint venture agreement providing the joint and several liabilities with respect to the contract.

4.6.2.—Qualification of a joint venture does not necessarily qualify any of its partners individually or as a partner in any other joint venture. In case dissolution of a joint venture, each one of the constituent firms may qualify if they meet all the qualification requirements, subject to the written approval of the Employer.

4.7.—Bid Capacity.

Applicants who meet the minimum qualification criteria will be qualified only if their available bid capacity at the expected time of bidding is more than the total estimated cost of the works. The available bid capacity will be calculated as under:

Assessed Available Bid Capacity = (A*N*2-B), where

A = Maximum value of work executed in any one year during the last five financial years i.e. from 2018-19 to 2023-24 (updated to the price level of the year indicated in appendix) taking into account the completed as well as works in Progress.

B = Value at current price level of the existing commitments and ongoing works to be completed during the next (period of completion of work for which bids are invited); and

N = Number of years prescribed for completion of the works for which the bids are invited.

Note :- In Case of joint venture, the available bid capacity will be applied for each partner to the extent of his proposed participation in the execution of the work. Some of the bid capacity of all the member shall be more than 4.7.

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

- Made misleading or false representation in the forms, statements and Attachments the submitted in proof the qualification requirements; and /or
- Record of poor performance such as abandoning the works, not properly completing the contract, inordinate delay in completion, litigation history, or financial failures etc.; and/or
- Participated in the previous bidding for the same work and had quoted unreasonably high bid prices and could not furnish rational justification to the employer.

5. One bid per bidder

5.1. Each bidder shall submit only one bid for one package. A bidder who submits or participates in more than one bid (other than as a subcontractor or in cases of alternatives that have been permitted or requested) will cause all the proposals with the bidder's participation to be disqualified.

6. Cost of Bidding

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

7. Site Visit

7.1. The Bidder, at the Bidder's own responsibility and risk is encouraged to visit and examine the Site of work and its surrounding and obtain all information that may be necessary for preparing the Bid and entering into a contract for construction of the Works.

The costs of visiting the site shall be at the Bidder's own expense.

8. Bidders Registration Class and Building Category

8.1. Registration certificate of R & B Registered in **B Class (Special Cat. Building III) / Water Resources Department, The contractors, who are registered in appropriate category of C.P.W.D., M.E.S., Railways and Indian State Governments**, can also bid provided the bidder produce such registration certificate at the time of bidding and obtain and submit registration in required class & category from the Gujarat State R&BD/W.R.D before issue of work order in case they emerge as L-1 Bidder. Bidder will solely be responsible for obtaining and submitting the certificate before issue of work order.

B. BIDDING DOCUMENTS

9. Content of Bidding Documents

- 9.1 The set of bidding documents comprises the documents listed below and addenda issued in accordance with Clause 10:

Section	Particulars	Volume No.
-	Invitation for Bids	I
1	Instructions to Bidders	
2	Qualification Information, and other forms	
3	Conditions of Contract	
4	Contract Data	
5	Technical Specifications	II
6	Form of Bid	III
7	Bill of Quantities	
8	Securities and other forms	
9	Drawings	IV
10	Documents to be furnished by bidder	V

82. Volumes I, II, III and IV are available online and documents to be furnished by the bidder in compliance to section 2 will be prepared by him and furnished as Volume-V in two parts (refer clause 12).
83. The bidder is expected to examine carefully all instructions, conditions of contract, contract data, forms, terms, technical specifications, bill of quantities, forms, Annexes and drawings in the Bid Document. Failure to comply with the requirements of Bid Documents shall be at the bidder's own risk. **Pursuant to clause 26 here of**, bids which are not substantially responsive to the requirements of the Bid Documents shall be rejected.

10. Clarification Bidding Documents

- 10.1 A prospective bidder requiring any clarification of the bidding documents may notify the Employer in writing or through E-mail at the Employer's address indicated in the invitation to bid. The Employer will respond to any request for clarification which he received earlier than 15 days prior to the deadline for submission of bids. Employer's response will be published on website including a description of the enquiry but without identifying its source.

9.2. Pre-bid meeting

- 9.2.1. The bidder or his official representative is invited to attend a pre-bid meeting which will take place at the address, venue, time and date as indicated in the appendix.

- 9.2.2. The purpose of the meeting will be to clarify issues and to answer questions on any matter that may be raised at that stage.
- 9.2.3. The bidder shall be required to submit any questions in writing or e-mail to reach the Employer not later than 03 days before the meeting.
- 9.2.4. Minutes of the meeting, including the question raised (Without identifying the source of enquiry) and the responses given will be published without delay on the tender website i.e. www.nprocure.com. Any modification of the bidding documents listed in sub-Clause 8.1 which may become necessary as a result of the pre-bid meeting shall be made by the Employer exclusively through the issue of an Addendum pursuant to Clause 10 and not through the minutes of the pre-bid meeting.
- 9.2.5. Non-attendance at the pre-bid meeting will not be a cause for disqualification of a bidder.

11. Amendment of Bidding Documents

- 11.1 Before the deadline for submission of bids, the Employer may modify the bidding documents by issuing addenda.
- 10.2. Any addendum thus issued shall be part of the bidding documents. The Employer will assume no responsibility for the same.
- 10.3. To give prospective bidders reasonable time in which to take an addendum into account in preparing their bids, the Employer may, at his discretion, extend as necessary the deadline for submission of bids, in accordance with Sub-Clause 20.2 below.

C. PREPARATION OF BIDS

12. Language of the Bid

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

13. Documents Comprising the Bid

12.1. The bid be submitted by the bidder as Volume V of the bid document (refer Clause 8.1) shall be in two separate parts:

Part I shall be named “Technical Bid” and shall comprise

- (i) Bid Security in the form specified in Section 8
- (ii) Qualification Information and supporting documents as specified in Section 2
- (iii) Certificates, undertakings, affidavits as specified in Section 2
- (iv) Any other information pursuant to Clause 4.5 of these instructions
- (v) Undertaking that the bid shall remain valid for the period specified in Clause 15.1

Part II shall be named “Financial Bid” and shall comprise

- (i) Form of Bid as specified in Section 6
- (ii) Priced Bill of Quantities for items specified in Section 7

12.2. The Bidder shall submit the details / information pertaining to each part i.e. technical as well as financial and must be submitted online only.

12.3. Following documents will be deemed to be part of the bid.

Section	Particulars	Volume No.
Invitation for Bids (IFB)		
1	Instruction to Bidders	Volume I
3	Conditions of Contract	
4	Contract Data	
5	Specifications	Volume II
9	Drawings	Volume IV

14. Bid Prices

14.1 The Contract shall be for the whole works as described in Sub-Clause 1.1, based on the priced Bill of Quantities submitted by the Bidder.

14.2 The bidder shall fill in rates and prices and line item total (both in figures and words) for all items of the Works described in the Bill of Quantities along with total bid price

(Both in figures and words). Items for which no rate or price is entered by the bidder will not be paid for by the Bill of Quantities.

- 14.3 All duties, taxes, and other levies except GST payable by the contractor under the contract, or for any other cause shall be included in the rates, prices and total Bid Price submitted by the Bidder. (GST will be paid extra)

14.4 Deleted

- 14.5 The rates and prices quoted by the bidder are subject to adjustment during the performance of the Contract in accordance with the provisions of Clause 47 of the Condition of Contract **(Irrespective of the time limit and Bid Amount)**

15. Currencies of Bid and Payment

- 15.1 The unit rates and the prices quoted by the bidder shall be entirely in Indian Rupees. All payments shall be made in Indian Rupees.

16. Bid Validity

- 16.1 Bids shall remain valid for a period of not less than 120 days from the date of technical bid opened.
- 16.2 In exceptional circumstances, prior to expiry of the original time limit, the Employer may request that the bidders may extend the period of validity for a specified period. A bidder may refuse the request without forfeiting his bid security. A bidder agreeing to the request will not be required or permitted to modify his bid, but will be required to extend the validity of his security for a period of the extension, and in compliance with Clause 16 in all respects.

#16. Bid Security

- 16.1. The Bidder shall furnish, as part of his Bid, a Bid security in the amount as shown in column 4 of the table of IFB for this particular work. This Bid security shall be in favor of Employer as named in Appendix and may be in one of the following forms;
- a. Bank Guarantee from any scheduled Indian bank, in the format given in Volume III. **(Bank Guarantee is applicable only for Bid Estimated Amount of 01 Crore and above) and Bank** Guarantee of Schedule and Private Banks shall be considered as per GoG Finance Department's Circular No. FD/MSM/e-file/4/2023/0057/D.M.O. Date 21/04/2023 or as per their latest amendment.
- b. Fixed Deposit Receipt issued by any Scheduled Indian Bank or a foreign Bank approved by the Reserve Bank of India.

OR

A Valid Bid Security / EMD Exemption Certificate issued by (1) Road & Building Department or (2) Narmada Water Resources, Water Supply and Kalpsar Department of Govt of Gujarat. **Exemption Certificate is applicable only when Registration Certificate of Appropriate Class and Category of Approved Contractors is required as eligible criteria of bidder.**

- 16.2. Bank guarantees (and other instruments having fixed validity) issued as surety for the bid shall be valid for 45 days beyond the validity of the bid i.e. total validity of 120+45 = 165Days
- 16.3. Any bid not accompanied by an acceptable Bid Security and not secured as indicated in Sub-Clauses 16.1 and 16.2 above shall be rejected by the Employer as non-responsive.
- 16.4. The Bid Security of unsuccessful bidders will be returned within 28 days of the end of the bid validity period specified in Sub-Clause15.1
- 16.5 The Bid Security of the successful bidder will be discharged when the bidder has signed the Agreement and furnished the required Performance Security.
- 16.6. The bid Security may be forfeited
- (a) If the Bidder withdraws the bid after Bid opening during the period of Bid validity.
 - (b) If the Bidder does not accept the correction of the Bid Price, if any or
 - (c) In the case of a successful Bidders, if the Bidder fails the specified time limit to
 - (i) Sign the Agree mentor
 - (ii) Furnish the requirement Performance Security.
 - (d) #If found necessary, the bidder will be intimated for negotiation, He will be intimated maximum three times within the validity period for negotiation, If contractor does not respond in time, his Bid Security (EMD) will be forfeited and his tender will be rejected. Punitive action will be taken on such contractors. (As per GoG R&B Dept's Gr. No. S/22/2017/6369/D,Dt.08/06/2018)

17. Alternative Proposals by Bidders.

- 17.1. Bidders shall submit offers that fully comply with the requirements of the bidding documents, including the conditions of contract (including mobilization advance or time for completion), basic technical design as indicated in the drawing and specifications. Conditional offers or alternative offers will not be considered further in the process of tender evaluation.

18. Format and Signing of Bid

- 18.1. The Bidder shall prepare documents comprising the bid as described in Clause 12 of these Instructions to bidder as the "Technical Bid "and "Financial Bid" in separate parts to be uploaded.

D. SUBMISSION OF BIDS

19. Deleted

20. Deadline for Submission of the Bids

- 20.1. Complete Bids must be received online by the Employer at the tender website specified above not later than the date indicated in appendix.
- 20.2. The Employer may extend the deadline for submission of bids by issuing an amendment in accordance with Clause 10, in which case all right and obligation of the Employer and the bidders previously subject to the original deadline will then be subject to the new deadline.

21. Deleted

22. Modification and Withdrawal of Bids

- 22.1. Bidders may modify or withdraw their bids online before the deadline prescribed in Clause 20 or pursuant to Clause 23.
- 22.2. Deleted
- 22.3. No bid shall be modified or withdrawn after the deadline for submission of Bid.
- 22.4. Withdrawal or modification of a bid between the deadline for submission of bids and the expiration of the original period of bid validity specified in Clause 15.1 above or as extended pursuant to Clause 15.2 may result in the forfeiture of the Bid security pursuant to Clause 16.

E. BID OPENING AND EVALUATION

23. Bid Opening

- 23.1 The Employer will open all the Bids received including modifications made pursuant to Clause 22, in the presence of the Bidders or their representatives who choose to attend at time, date and the place specified in Appendix in the manner specified in Clauses 20 and 23.3, In the event of the specified date of Bid opening being declared a holiday for the Employer, the Bids will be opened at the appointed time and location on the next working day.
- 23.2. Deleted.
- 23.3. The “Technical Bid” shall be opened. The amount, form and validity of the bid security furnished with each bid will be announced. If the bid security furnished does not conform to the amount and validity period as specified in the invitation for bid (ref. Column 4 and paragraph 3), and has not been furnished in the form specified in Clause 16, the technical bid will not be opened.
- 23.4. (i) Subject to confirmation of the bid security by the issuing Bank, the bids accompanied with valid bid security will be taken up for evaluation with respect to the Qualification information and other information furnished in part I of the bid pursuant to Clause 12.1.
- (ii) If required, the bidder will be asked in writing to clarify his Qualification Documents with respect to any required clarification.
- (iii) The bidders will respond in not more than 7 days of issue of the clarification letter.
- (iv) Immediately (usually within 3 or 4 days), on receipt of these clarification the Evaluation Committee will finalize the list of responsive bidders whose financial bids are eligible for consideration.
- 23.5. Deleted
- 23.6 At the time of opening of “Financial Bid”, the names of the bidders were found responsive in accordance with Clause 23.4(iv) will be announced. The bids of only these bidders will be opened. The responsive Bidders’ names, the Bid prices, the total amount of each bid, any discount and such other details as the Employer may consider appropriate, will be announced by the Employer at the opening.
- 23.7 the time of opening of “Financial Bid”, the names of the bidders were found responsive in accordance with Clause 23.4(iv) will be announced. The bids of only these bidders will be opened. The responsive Bidders’ names, the Bid prices, the total amount of each bid, any discount, and such other details as the Employer may consider appropriate, will be announced by the Employer at the opening.
- 23.8 In case bids are invited for more than one package, the order for opening of the “Financial Bid” shall be in order of Estimated amount of Bids from highest to lowest.
- 23.9 The Employer shall prepare minutes of the Bid opening, including the information disclosed to those present in accordance with Sub-Clause 23.6.

24 Process to be Confidential

- 24.1 Information relating to the examination, clarification, evaluation, and comparison of Bids and recommendations for the award of a contract shall not be disclosed to Bidders or any other persons not officially concerned with such process until the award to the successful Bidder has been announced. Any effort by Bidder to influence the Employer's processing of Bids or award decisions may result in the rejection of his Bid.

25. Clarification of Financial Bids

- 25.1. To assist in the examination, evaluation, and comparison of Bids, the Employer may, at his discretion, ask any Bidder for clarification of his Bid, including breakdowns of unit rates. The request for clarification and the response shall be in writing or by e-mail, but no change in the price or substances of the Bid shall be sought, offered, or permitted except as required to confirm the correction of arithmetic errors discovered by the Employer in the evaluation of the Bids.
- 25.2 Subject to sub-clause 25.1, no Bidder shall contact the Employer on any matter relating to his Bid opening to the contract is awarded. If the Bidder wishes to bring additional information to the notice of the Employer, it should do so in writing.
- 25.3. Any effort by the Bidder to influence the Employer in the Employer's bid evaluation, bid comparison or contract award decision may result in the rejection of the Bidders' bid.

26. Examinations of Bids and Determination of Responsiveness

- 26.1 During the detail evaluation of "Technical Bid", the Employer will determine whether each Bid (a) meets the eligibility criteria defined in Clause 3 and 4; (b) has been properly signed; (c) is accompanied by the required securities and; (d) is substantially responsive to the requirements of the Bidding document. During the detailed evaluation of the "Financial Bid", the responsiveness of the bids will be further determined with respect to the remaining bid conditions, i.e., priced bill of quantities, technical specifications, and drawings.
- 26.2 A substantially responsive "Financial Bid" is one which confirms all the terms, conditions and specifications of bidding documents, without material deviation or reservation. A material deviation or reservation is one (a) which affects in any substantial way the scope, quality, or performance of the Works; (b) which limits in any substantial way, inconsistent with the Bidding documents, the Employer's rights or the Bidder's obligations under the Contract; or (c) whose rectification would affect unfairly the competitive position of other Bidders presenting substantially responsive Bids.
- 26.3 If a "Financial Bid" is not substantially responsive, it will be rejected by the Employer, and may not subsequently be made responsive by correction or withdrawal of the non-conforming deviation or reservation.

27. Deleted

28. Deleted

29. Evaluation and Comparison of Financial Bids

- 29.1. The Employer will evaluate and compare only the Bids determined to be substantially responsive in accordance with Sub-Clause 26.2.
- 29.2. Deleted.
- 29.3. The Employer reserves the right to accept or reject any variation or deviation. Variation and deviations and other factors, which are in excess of the requirements of the Bidding documents or otherwise result in unsolicited benefits for the Employer, shall not be taken in to account in Bid evaluation.
- 29.4. The estimated effect of the price adjustment conditions under Clause 47 of the Conditions of Contract, during the period of implementation of the Contract, will not be taken in to account in Bid evaluation.
- 29.5. If the Bid of the successful Bidder is seriously unbalanced in relation to the Engineer's estimate of the cost of work to be performed under the contract the Employer may require the Bidder to produce detailed consistency of those prices with the construction methods and schedule proposed. After evaluation of the price analyses, the Employer may require that the amount of the performance security set forth in Clause 34 be increased at the expense of the successful /bidder to a level sufficient to protect the Employer against financial loss in the event of default of the successful Bidder under the Contract.
- 29.6. A bid which contains several items in the bill of Quantities which are unrealistically priced low and which cannot be substantiated satisfactorily by the bidder may be rejected as non-responsive. (Applicable for item rate tender only)

30. Deleted

F. AWARD OF CONTRACT

31. Award Criteria

31.1. Subject to Clause 32, the Employer will award the contract to the Bidder whose Bid has been determined.

- (i) to be substantially responsive to the Bidding documents and who has offered the lowest evaluated Bid Price ;and
- (ii) to be within the available bid capacity adjusted to account for his bid price which is the lowest evaluation in any of the packages opened earlier than the one consideration.

In no case, the contract shall be awarded to any bidder whose available bid capacity is less than the evaluated bid price, even if the said bid is the lowest evaluated bid. The contract will in such cases be awarded to the next lowest bidder at his evaluation bid price.

32. Employer's Right to Accept any Bid and to Reject any or all Bids

32.1. Notwithstanding Clause 31, the Employer reserves the right to accept or reject any Bid, and to cancel the Bidding process and reject all Bids, at any time prior to the award of contract, without thereby incurring any liability to the affected bidder or Bidder or any obligation to inform the affected Bidder or Bidders of the grounds for the Employer's action.

33. Notification of Award and Signing of Agreement

33.1. The Bidder whose Bid has been accepted will be notified of the award by the Employer prior to expiration of the Bid validity period by cable, telex or facsimile confirmed by registered letter. This letter (hereinafter and in the condition of contract called the "Letter of Acceptance") will state the sum that the Employer will pay the Contractor in consideration of the execution, completion, and maintenance of the Works by the Contractor as prescribed by the Contract (hereinafter and in the Contract called the "Contract Price").

33.2 The notification of award will constitute the formation of the contract, subject only to the furnishing of a performance security in accordance with the provisions of Clause.

33.3. The Agreement will incorporate all agreements between the Employer and the successful Bidder. It will be signed by the Employer and to the successful Bidder, within 28 days following the notification of award along with the Letter of Acceptance. Within 21 days of receipt, the successful Bidder will sign the Agreement and deliver it to the Employer.

33.4. Upon the furnishing by the successful Bidder of the Performance Security, the Employer will promptly notify the other Bidders that their Bids have been unsuccessful.

34. Performance Security

34.1. (A) Within 10 (Ten) days of receipt of Letter of Acceptance, the successful Bidder shall furnish to the Employer an irrevocable and unconditional guarantee from a Bank in the form set forth in Section 8 (the "Performance Security") for an amount equal to 5% (five percent) of its Contract Price. In case of bids mentioned below, the successful Bidder, along with the Performance Security,

shall also furnish to the Authority an irrevocable and unconditional guarantee from a Bank in the same form given at Section 8 towards an Additional Performance Security (The “Additional Performance Security”) for an amount calculated as under:

- (a) If the Contract Price offered by the Selected Bidder is lower than 10% but upto 20% of the Estimated Project Cost, then the Additional Performance Security shall be calculated @ 20% of the difference in the (i) Estimated Project Cost (as mentioned in Bid Document) - Minus 10% of the Estimated Project Cost and (ii) Contract Price offered by the selected Bidder.
- (b) If the Contract Price offered by the Selected Bidder is lower than 20% of the Estimated Project Cost, then the Additional Performance Security shall be calculated @ 30% of the difference in the (i) Estimated Project Cost (as mentioned in Bid Document) - Minus 10% of the Estimated Project Cost and (ii) Contract Price offered by the selected Bidder.
- (c) This Additional Performance Security shall be treated as part of the Performance Security.

34.1 (B) The Performance Security shall be valid beyond 60 (Sixty) days **from the stipulated date of completion of the project** and the Additional Performance Security shall be valid beyond 28 (twenty-eight) days of Project Completion Date.

- (d) Performance Security shall become refundable/releasable within 15 days after certified project completion date subject to Fulfillment of contractual obligation and settlement of all dues and claims.

34.2. If the performance security is provided by the successful Bidder in the form of a Bank Guarantee, it shall be issued either (a) at the Bidder’s option, by a Nationalized/Scheduled Indian bank or (b) by a foreign bank located in India and acceptable to the Employer. As per GoG Finance Department’s Circular No. FD/MSM/e-file/4/2023/0057/D.M.O. Date 21/04/2023 or as per their latest amendment.

34.3. Failure of the successful Bidder to comply with the requirement of Sub-Clause 34.1 shall constitute sufficient grounds for cancellation of the award and forfeiture of the Bid Security.

35 Advance Payment and Security

35.1 The Employer will provide an Advance payment on the Contract Price as stipulated in the Conditions of Contract, subject to maximum amount, as stated in the Contract Data.

36. Deleted

37. Corrupt or Fraudulent Practices

37.1 The Employer will reject a proposal if it determines that the Bidder recommended for award has engaged in corrupt or fraudulent practices in completing for the contract in question and will declare the firm ineligible, either indefinitely or for a stated period of time, to be awarded a contract with National Highways Authority of India/ State PWD and any other agencies, if it at any time determines that the firm has engaged in corrupt or fraudulent practices in completing for the contractor, or in execution.

37.2 Furthermore, Bidders shall be aware of the provision stated in Sub- Clause 59.2 of the Conditions of Contract.

APPENDIX TO ITB

Clause Reference With respect to Section -I

1. The Name of the Employer is Principal Secretary, Health and Family Welfare Department [Cl.1.1]
2. ~~The last five/Seven years.~~
~~20___-20___~~
~~20___-20___~~
~~20___-20___~~
3. ~~This Annual Financial Turnover Amount is Rs.~~ [Cl.4.5.3 (a)]
~~.....~~
4. Value of Work is Rs. 1,71,01,971.74
5. Deleted
6. The cost of electric work is Rs. Included in Main work
7. The cost of water supply / sanitary works is Rs. Included in Main work
8. Liquid assets and / or availability of credit facilities (i.e.25% of contract value/ estimated cost) is Rs. [Cl.4.5.6]
9. ~~Price level of the financial year~~ [Cl. 4.5.2]
10. The pre-bid meeting will take place at [Cl. 9.2.1]
11. The technical Bid will be opened at the office of the.....on dt..... atAM/PM
12. Address of the Employer: Principal Secretar, Health & Family welfare Department, New Sachivalay, Block No:- 7/7, Gandhinagar
13. Deleted
14. The bid should be submitted latest by [Cl. 20.1 & 20.2]
As stated on online NIT
15. The bid will be opened at [Cl. 23.1]
As stated on online NIT
16. The Bank Draft in favour of "PIU GENERAL FUND
A/C 11-114"
17. Deleted
18. ~~Escalation factors (for the cost of works executed and financial figure to a common base value) for works completed~~ [Cl.4.5.2]

<u>Year</u>	<u>Financial Year</u>	<u>Multiplying factor</u>
Base year of inviting tender	20__-20__	1.00
-1	20__-20__	1.10
-2	20__-20__	1.21
-3	20__-20__	1.33
-4	20__-20__	1.46
-5	20__-20__	1.61

#LIST OF KEY PLANT & EQUIPMENT TO BE DEPLOYED ON CONTRACT WORK

[Reference CL. 4.5.5]

For building works upto 2 Cr. and as mention under:

The contractors shall also give a list of machineries in his possession and which they propose to use on the work.

Sr. No.	Plant or Machinery	Nos.	Location	Age of Machinery (maximum 15 years)	Make	Capacity	Approximate Value	Remark
1	2(a)	2(b)	2(c)	3	4	5	6	7
1	Tipper Trucks	2	-					
2	Concrete mixer with integral way batch facility	2						
3	Needle Vibrator	4						
4	Surface Vibrator	2						
5	Diesel Generator	1						
6	Concrete Conveying System and Trolley	1						
7	Excavator	1						
8	Steel/ Wooden shuttering (Scaffolding, props)	2000 Sqmt						
9	Concrete breaker	1						
10	Surveying Equipment (Total Station & Other)	1						
11	Welding machine	1						
12	Bar Bending and Cutting machines	1						
13	Goods lift for	1				minimum capacity of 300 Kg.		
14	Water tanker	1						

For building works more than Rs. 2 Cr. and less than Rs.7 Cr. as mention under:

The contractors shall also give a list of machineries in his possession and which they propose to use on the work.

Sr. No.	Plant or Machinery	Nos.	Location	Age of Machinery (maximum 15 years)	Make	Capacity	Approximate Value	Remark
1	2(a)	2(b)	2(c)	3	4	5	6	7
1	Tipper Trucks	3	-					
2	Concrete mixer with integral way batch facility or Concrete batching plant with automatic way batching facility (15 CMT Capacity)	3 Or 1						
3	Needle Vibrator	4						
4	Surface Vibrator	2						
5	Diesel Generator	1						
6	Concrete Conveying System and Trolley	1						
7	Excavator	1						
8	Steel/ Wooden shuttering (Scaffolding, props)	5000 Sqmt						
9	Concrete breaker	1						
10	Surveying Equipment (Total Station & Other)	1						
11	Welding machine	1						
12	Bar Bending and Cutting machines	1						
13	Goods lift for	1				minimum capacity of 300 Kg.		
14	Water tanker	2						

For building works more than Rs.7 Cr. as mention under (Sub District Hospitals, District Hospitals, Teaching Hospitals, Medical Colleges, Hostels and Other buildings):

The contractors shall also give a list of machineries in his possession and which they propose to use on the work.

Sr. No.	Plant or Machinery	Nos.	Location	Age of Machinery (maximum 15 years)	Make	Capacity	Approximate Value	Remark
1	2(a)	2(b)	2(c)	3	4	5	6	7
1	Concrete batch-mix plant with electronic control panel Minimum-30Cu.Mt/Hr. Admixture unit	1	-					
2	Hopper Mixer	4						
3	Steel/ Wooden shuttering (Scaffolding, props) or as suggested by Engineer in Charge	10000 Sqmt.						
4	Steel props (with Adjustable accessories)	20000 Nos.						
5	Excavator	3				Poelan 0.9 Cmt. Bucket capacity		
6	Trucks / Dumpers with capacity not less than 5 Cum	5						
7	Concrete mixture machine with integral weigh batching facilities	5						
8	Needle Vibrator	10						
9	Surface vibrators	10						
10	Laboratory set up List of site Laboratory Testing Machines (Attach Separate List)	1						
11	Air compressor	2 (Big, Small)						
12	Concrete breaker	2						
13	Welding machine	2				minimum capacity of 300 Kg.		
14	Surveying Equipment (Total Station & Other)	2						
15	Construction Tower Cranes (20 Tone)	1						
16	Bar Bending and Cutting machines	3						
17	Goods cum lift for minimum capacity of 300 Kg.	2						
18	Water Tanker	3						
19	Concrete pouring Pump and Motor	2 set						
20	RMC Transit Mixture	6						
21	Suspended Scaffold	5000 Sqmt						

List of Key Personnel to be deployed on Contract Work (Reference Cl. 4.5.4)

Employment of a qualified site Engineer by the Contractor.

The Contractor shall employ full-time technically qualified staff during the execution of this work as under: -

1. One graduate Civil Engineers and One diploma Civil Engineers when cost of the work to be executed is more than Rs.50lakhs but less than Rs.200 lakhs and above Rs. 2 Cr. to Rs. 7 Cr. additional One graduate Electrical Engineer and above Rs. 7 Cr. for Sub District, District Hospital, Medical College additional as per table mention at Sr.No. 5
2. One graduate & two Diploma, Civil Engineers when the cost of the work to be executed is more than Rs.15 lakhs but less than Rs.50lakhs.
3. Minimum one Diploma Civil Engineer when the cost of work is less than Rs.15 lakhs but more than Rs.5lakhs.
4. Minimum two Diploma Civil Engineers for the work when the cost of work to be executed is less than Rs. 5 lakhs. The Engineer so employed for the Government work must have sufficient experience to handle the work independently. Such an Engineer shall have to stay at the site of work and he shall not be entrusted with other duty except this work.
5. And Additional as under: **Table to add**

Bidder should propose the structure and composition of the team dedicated for carrying out the Assignment. Bidder should list the main disciplines of the assignment, the key personnel responsible, and proposed technical and support staff. The personnel schedule shall be consistent with the approach and methodology, detailed work plan, activity schedule.				
Sr. No	Position	No. Of Resources	Min Qualification	Deployment
Key Personal				
1	Project Manager	1	BE (Civil) + 15 Years' Experience into Construction Work or M.E. + 10 Year Experience	Full time for Project
2	Project Engineer	1	BE (Civil) + 10 year	Full time for Project
2	Sr. Civil Engineer	2	BE (Civil) + 7 Year of Experience into Construction Works or M.E. + 5 Year Min, Min 1 Engineers know AutoCAD Application	Full time for Project
3	Jr. Civil Engineer	3	BE (Civil) + 3 Year of Experience into Construction Works, Min 2 Engineers know AutoCAD Application	Full time for Project
4	Sr. MEPF Engineer	1	BE (Electrical / Mechanical) + 7 Year of Experience into Construction Works	Full time when concern work ongoing
5	Sr. Electrical Engineer	1	BE (Electrical) + 7 Year of Experience into Construction Works	Full time when concern work ongoing
6	Jr. Electrical Engineer	2	BE (Electrical) + 3 Year of Experience into Construction Works	Full time when concern work ongoing
7	Sr. Mechanical Engineer	1	BE (Mechanical) + 5 Year of Experience into Construction Works	Full time when concern work ongoing
8	Structural Design Expert	1	ME (Structure) + 5 Year of Experience	Periodic Visit / As and when required
9	Bio-Medical	1	Shall Have experience of Min 5 Years	Periodic Visit / As

	Specialist			and when- required
10	Surveyor	1	Diploma (Civil) or ITI (Survey) At least 5-year experience	Full time for Project
11	Safety Engineer	1	Graduate (Civil Engineer)	Full time for Project
12	Lab Technician	1	BE (Civil) + 3 Years Experience / Diploma (Civil) + 5 Years Experience	Full time for Project
13	Store Keeper	1	-	Full time for Project
14	Administrative Team (Computer Operator)	2	Sufficient Manpower to be deploy to make sure all requirement of resources are available at all time so that work should not affected.	Full time for Project
15	Purchase Team	2		

Within 15 days of issue of work-order the Contractor will have to furnish to the Deputy Executive Engineer-in-charge of the work the Name, Qualifications, copy of marksheet, Colour Photograph and the appointment order issued such engineers engaged for this contract work. If 15 days after issue of work order such designated Site Engineers do not resume or do not remain present on site of work, the recovery at the rate of Rs.15,000-00 per month per Engineer will be made from the bills/deposit/dues of the contractor. Such recovery shall be non-refundable.


Dy. Executive Engineer
Project Implementation Unit
Bhuj - Kutch


Executive Engineer
Project Implementation Unit
Bhuj - Kutch

SECTION - 2

QUALIFICATION INFORMATION

QUALIFICATION INFORMATION

The information to be filled in by the Bidder in the following pages will be used for the purpose of post qualification as provided for in Clause 4 of the Instruction to Bidders. This information will not be incorporated in the Contract.

1. For Individual Bidders

1.1 Constitution or legal status of Bidder (Attach Copy)

Place of registration _____

Principal place of business _____

Power of attorney of signatory of Bid

(Attach)

1.2 Total value of Civil engineering constructions Work performed in the last five/ seven years (in Rs. Lakhs)

Year	Work done value (in Rs. Lakhs)	Supporting documents certified by CA
2017-18		
2018-19		
2019-20		
2020-21		
2021-22		
2022-23		
2023-24		

1.3.1 Work performed as prime contractor, work performed in the past as a nominated sub-contractor will also be considered the sub-contract involved execution of all main items of work described in the bid documents, provided further that all other qualification criteria are satisfied (in the same name) on works of a similar nature over the last five years and in current year before the submission of the bid.**

Project Name	Name of the Employer	Description of work	Contract No.	Value of contract (Rs. Crore)	Date of issue of work order	Stipulated period of completion	Actual date of completion*	Remark explaining reasons for delay & work Completed

*Attach certificate(s) from the Engineer(s) in charge

** Immediately preceding the financial year in which bids are received.

Preferably standard 3-A certificate issued by various government authority/ if work is private it should be by employer and private work should be supported by TDS work order, final bill payment, work order and as instructed in ITB.

~~#1.3.2 Quantities of work executed as prime contractor, work performed, in the past as a nominated sub-contractor, will also be considered provided the sub-contract involved execution of all main items of work described in the bid document, provided, further that all other qualification criteria are called (in the same name and style) in the last five years** and in current year before the submission of the bid.~~

Year	Name of the work	Name of the Employer	Quantity/Capacity of work performed (Capacity or Amount) particularly for health facilities- Hospital, Medical College, Hostels, etc.)								Remarks
			MGPS		CSSD System	HVAC (Capacity)	Fire System	ELV	Lift Work	MOT	
			No. of Points	Value	Value	Value of Work	Value of Work	Value of Work	Value of Work	Nos.	
20-20											
20-20											
20-20											
20-20											
20-20											

~~1.4 Information on Bid Capacity (works for which bids have been submitted and works which are yet to be completed) as on the date of this bid.~~

~~(A) Existing commitments and on-going works:~~

Name of Building/Hospital-works	Place & State	Contract No.	Name & Address of Employer	Value Contract (Rs. Cr)	Stipulated Period of Completion	Value of Works* remaining to be completed (Rs. Cr)	Anticipated of completion	Remarks
1	2	3	4	5	6	7	8	9

~~*Attach certificate (s) from the Engineer(s) in-charge~~

~~** Immediately preceding the financial year in which bids are received.~~

~~1.5 Availability of key items of Contractors Equipment for carrying out the works (Ref. Clause 4.5.5). The Bidder should list all the information requested below.~~

Sr. No.	Plant or Machinery	Nos.	Location	Age of Machinery (maximum 15 years)	Make	Capacity	Approximate Value	Remark
1	2(a)	2(b)	2(c)	3	4	5	6	7

- 1.6 ~~Qualifications and experience of key personnel required for administration and execution of the contract. Attach biographical data. Refer also to Sub Clause 9.1 of the Conditions of Contract.~~

Bidder should propose the structure and composition of the team dedicated for carrying out the Assignment. Bidder should list the main disciplines of the assignment, the key personnel responsible, and proposed technical and support staff. The personnel schedule shall be consistent with the approach and methodology, detailed work plan, activity schedule.				
Sr. No	Position	No. Of Resources	Min Qualification	Deployment
Key Personal				

- 1.7 ~~Proposed sub-contract and firms involved~~

Sections of the works	Value of Sub-Contractor	Sub-Contractor (Name& Address)	Experience in similar work
MGPS			
MOT			
ELV			
HVAC			
Fire System			
Lift/ Elevators			
CSSD			
MEP			
Any Other sub work			

~~Attach copies of certificates on possession of valid license for executing water supply/ sanitary work/ building electrification works.~~

- ~~1.8 Financial reports for the last five years: balance sheets, profit and loss statements, auditors' reports (in case of companies/corporations), etc. List them below and attach copies.~~
- ~~1.9 Evidence of access to financial resources to meet the qualification requirements: cash in hand, lines of credit, etc. List them below and attach copied documents.~~
- ~~1.10 Name, address, and telephone, mobile number and Email ID of the Bidders bankers who may provide references if contacted by the Employer.~~
- ~~1.11 Information on Litigation history in which the Bidder is involved.~~

Other Party (ies)	Employer	Cause of Dispute	Amount Involved	Remarks showing Present Status

- ~~1.12. Statement of compliance under the requirements of Sub Clause 3.2 of the instruction to Bidders. (Name of Consultant engaged for project preparations*)~~

- ~~1.13 Proposed work method and schedule. The Bidder should attach descriptions, drawings and charts as necessary to comply with the requirements of the Bidding documents. (Refer ITB Clause 4.1)~~

- ~~1 Key Plan~~
- ~~2 Sectional Elevation~~
- ~~3 Campus Layout~~
- ~~4 Water Supply & Sewage Points~~
- ~~5 Any other~~

- ~~1.14 Programme~~

~~2. Deleted~~

~~3. Additional Requirements~~

- ~~3.1 Bidders should provide any additional information required to fulfill the requirements of Clause 4 of the Instructions to the Bidders, if applicable.~~

- ~~(i) Affidavit~~
- ~~(ii) Undertaking~~

~~* Fill the name of consultant~~

**SAMPLE FORMAT FOR EVIDENCE OF ACCESS TO OR
AVAILABILITY OF CREDIT FACILITIES**

(CLAUSE 4.5.6 OF ITB)

BANK CERTIFICATE

This is to certify that M/s. _____ is a reputed company with a good financial standing.

If the contract for the work, namely _____ is awarded to the above firm, we shall be able to provide overdraft/credit facilities to the extent of Rs. _____ to meet their working capital requirements for executing the above during the contract period. **Estimated Cost**

(Signature)

Name of Bank

Senior Bank Manager

Address of the Bank

APPENDIX – A

(Form No. 3 A) (Self attested)

Referred to in Rules No. 1.3.1

DETAILS OF SIMILAR WORK COMPLETED

1. _____ Name of Contractor _____ :
2. _____ Name of Work _____ :
3. _____ Estimated cost of Work put to tender _____ :
4. _____ Revised Estimated Cost _____ :
5. _____ Tender Amount _____ :
6. _____ Date of Starting the Work _____ :
7. _____ Date of completion of the work (As per contract agreement) _____ :
8. _____ Actual date of the Completion of work _____ :
9. _____ Amount of Actual completion of the total project _____ :
_____ A) _____ Electrical Work cost:
_____ B) _____ HVAC Work cost:
_____ C) _____ ELV Work cost:
_____ D) _____ MGPS Work cost:
_____ E) _____ CSSD Work cost:
_____ F) _____ MOT Work cost:
10. _____ State whether the details as above given by the contractor are correct if not state as to what is the correct information _____ :
11. _____ State whether the contractor has executed the work in progress. Satisfactory as per specification if not give the correct position of the work. _____ :
12. _____ Period rate & amount of compensation if levied. _____ :
13. _____ Period of extension granted if any _____ :
14. _____ Reason for delay in granted if any _____ :
15. _____ Any other remarks _____ :

Particulars of work completed:

Date: _____

_____ **Authorized Signature**

APPENDIX-B

LAB TESTING EQUIPMENT

The BIDDERS shall provide adequate information for testing equipment and surveying equipment

	Name of Testing Equipment	Minimum Requirements	Equipment with Agency	
			Equipment in hand	Equipment to be procured
1	A-General Lab Equipment			
	a) Electronic balance 7Kg. to 10Kg. capacity semi self-indication type accuracy 1gm.	2Nos.		
	b) Pan balance 10kg capacity accuracy 0.01gm	12 nos.		
	c) Electronic balance 500gm capacity accuracy 0.001gm	2Nos.		
	f) Sieves as per I.S. 460-1962	Full IISet.		
	II) Stop watches, 1/5 sec. accuracy	2Nos.		
2	B-For Cement and Cement Concrete			
	I)-Moulds			
	a) 150mm _____ dia. x 300mm height cylinder with capping component	As required		
	b) Cubes 150mm	As required		
	III) High frequency mortar cube vibrator for cement testing	1No.		
	iv) Concrete mixer power driven, 0.03m ³ capacity	1No.		
	V) Variable _____ frequency and amplitude vibrating table size 1 meter x 1 meter as per the relevant British standard.	1No.		
	Vi) Flow table as per the relevant IS specifications.	4Nos.		
	Vii) a) 2000Kn (Least count 10Kn) compression testing machine for concrete cube.	1No.		
	b) 500 Kn (least count 2 Kn) compression testing machine for cement mortar cube.	1No.		
	viii) Equipment for slump test	2Nos.		
	xi) Needle Vibrator	1No.		
	xii) Cement Testing Equipment	1No.		
	xiii) Soil Testing Equipment	1No.		
	xiv) Aggregate Testing Equipment	1No.		
	Apparatus of Drinking Water: Total Dissolved Solid	1No.		
	Apparatus of water for construction purpose: Acidity, Alkalinity, Chloride, Inorganic Solid, Organic Solid, pH, Sulphate, Total Suspended Solid	1No.		

	Apparatus of Brick: Compressive Strength, Compressive Strength, Dimension Height, Dimension Length, Dimension width, Efflorescence, Water Absorption	1No.		
	Apparatus of Cement: Compressive Strength, Density, Fineness by Blain's air permeability, Nominal Consistency, Setting time (Final), setting time (Initial), soundness by Le Chatelier	1No.		
	Apparatus of Coarse Aggregate: 10% Fine value, Crushing Value, Elongation Index, Flakiness index, Impact value, Loss Angle Abrasion, Sieve Analysis (sieve size 75micron to 90mm), specific Gravity, Water absorption	1No.		
	Apparatus of Concrete: Compressive strength, Slump test	1No.		
	Apparatus of Fine Aggregate: Bulk Density, Material finer than 75u, Sieve Analysis (sieve size 75micron to 90mm), Specific Gravity, water absorption	1No.		
	Apparatus of Paver block: Compressive Strength, water absorption	1No.		
	Apparatus of Steel HSD Bar/TMT Bar: Yield Strength, Elongation, Section weight per meter, Ultimate Tensile Strength	1No.		
	Apparatus of Soil: Liquid Limit, Plastic Limit, grain Size analysis, Specific Gravity, Unconfined compression strength, Direct Shear (Angle), Direct shear (C), Standard penetration test	1No.		
	Apparatus of Any Reinforced Concrete structure surface: Cover measurement of Reinforcement from top surface of member	1No.		
	Apparatus of Any Reinforced Concrete surface: Half Cell Potential Corrosion Measurement test, Pulse velocity test in concrete specimen, Rebound Hammer test on Concrete surface	1No.		
	Apparatus of Concrete Element (Core) : Carbonation	1No.		

ANNEXURE -C

Format: Joint Venture

Referred to in Rules No. 4.6

(1) ~~The Joint Venture Agreement made and entered into at _____~~
~~_____ day of _____ (year) by _____ and between _____.~~

a. ~~Firm A (Name with address of the registered office) _____~~

b. ~~Firm B (Name with address of the registered office) _____~~

(2) ~~**Definitions:** In this deed the following words and expressions shall have the meaning set out below.~~

a. ~~"The Authority" shall Project Implementation Unit, Gandhinagar.~~

b. ~~"The Works" shall mean~~

~~(Name of work) which is more particularly _____ described in the pre-qualification and tender documents issued thereof by the Authority.~~

c. ~~The Tender "shall" mean the tender to be submitted by Joint Venture to the Authority for the work/works.~~

d. ~~"The Contract" shall mean the contract entered/to be entered into between the Joint Venture and the Authority for the works.~~

(3) ~~**Joint Venture (JV)**~~

~~The Parties hereto declare that they have agreed to form a Joint Venture for the purpose of submitting the pre-qualification Application/tender document initially and then tender and if successful for the execution of the works as an integrated Joint Venture. The parties are not under this agreement entering into any permanent partnership of Joint Venture to tender or undertake any contract other than the subject works. Nothing herein contained shall be considered to constitute the parties of partners to constitute either Party the agent of the other.~~

(4) ~~**Witnesses:** Whereas Project Implementation Unit, Gandhinagar /Authority has invited tenders from intending bidders and the Authority has permitted a group of firms (not exceeding three) forming a Joint Venture to be eligible to be a bidder. And whereas _____ party of the first part, _____ party of the second part and _____ party of the third part are desirous to enter into a Joint Venture in the nature of partnership engaged in the joint undertaking for the specific purpose of execution of the work of constructing _____ and whereas Parties of the First, Second and Third part reached understanding to submit pre-qualification/tender, if pre-qualified, and to execute the contract if awarded;~~

This agreement witnesses as follows:

(a) ~~The parties do not enter into an agreement of any permanent partnership of Joint Venture to tender or undertake any Contract other than the specified above;~~

(b) ~~That the operation of this Joint Venture firm concerns and is confined to the work of _____ of Authority.~~

(c) ~~The name of the Joint Venture firm for convenience and continuity _____ shall be _____.~~

~~(d) — The Address of Joint Venture for communications shall be as under:~~

~~.....
.....
.....~~

~~(e) — The Joint Venture shall jointly submit pre-qualification application on the above name according to all terms and conditions stated in the relevant instructions contained in the bid documents.~~

~~(f) — That this Joint Venture shall regulate the relations between the parties thereto and shall include without being limited to them the following conditions:~~

~~(1) — _____ firm shall be the lead company in charge of the Joint Venture for all intents and purpose.~~

~~(2) — In case the said work is awarded to the Joint Venture, the partners of the Joint Venture _____ will nominate a person with duly _____ notarized power of Attorney on stamp paper, who will represent the Joint Venture with the authority to incur liabilities, receive instructions and payments, sign and execute the contract for and on behalf of the Joint Venture,~~

~~(i) — All the (Maximum two) parties agree to make financial participation and to place at disposal of Joint Venture the benefits of its individual experience, technical knowledge skill and shall in all respect bear its share as regards planning and execution of the work and responsibilities including the provision of information, advice and other assistance required in the Joint Venture and participation shall be in proportion of, Firm-A.....% and Firm-B.....%~~

~~(ii) — All rights, interests, liabilities, obligations work experience and risks (and all net profits or net losses) arising out of the contract shall be borne by the parties in proportion to their shares. Each of the parties shall furnish its proportionate share in any bonds, guarantees, sureties required for the works as well as its proportionate share in connection with the works. The share and participation of the two/three partners in working capital and other financial requirements shall be in ratio as mentioned above.~~

~~(5) — Internal responsibilities and liabilities~~

~~(a) — The division of individual scope of work may be worked out mutually by the parties but the party shall be jointly and severally liable to the Authority for the whole work.~~

~~(b) — The parties specifically undertake to carry out their separate works in full compliance with the contract with the Authority. Each party shall be responsible jointly and severally for consequences if any arising out of defective or delayed execution of works which fall within the individual's party's area of responsibility and/or it has been caused due to acts and/or omission of the concerned party.~~

~~(c) — The parties jointly and severally agree to replace modify or repair any defect in their respective portions of works in accordance with the terms and condition of the Contract with the Authority.~~

~~(d) — The parties jointly and severally shall indemnify and hold harmless to each other against any claim made by the Authority or any other third party for injury, damage,~~

~~loss or expenses is attributed to the breach/non-performance of his responsibilities by the indemnifying party in accordance with the agreements and/or Contract with the Authority.~~

~~(e) None of parties have joined in any other Joint Venture for the said works.~~

~~(6) Responsibilities and liabilities of Joint Venture towards the Authority~~

~~(a) Parties hereto shall be jointly and severally liable and responsible for the acts, deeds and things done or omitted to be done in respect of the execution of the Contract and for any financial liability arising therefrom.~~

~~(a) Parties hereto shall be jointly and severally responsible to the Authority for the execution of the works in accordance with the Contract Conditions;~~

~~(c) Parties hereto shall be jointly and severally indemnifying to the Authority against any claim made against the Authority or any other third party for any injury, damage or loss which may be attributed to the breach of the obligations under the Contract pursuant to the Contract.~~

~~(7) Site management~~

~~(a) The execution of the work on the site will be managed by a Project Manager appointed _____ by the Joint Venture and who will report to the _____ (JV). The Project Managers shall be authorized to represent the Joint Venture on site in respect of matters arising under the Contract.~~

~~(b) The _____ (Name of the JV) shall be jointly and severally liable to the Authority for the execution of the Contract commitment in respect of the works in accordance with Contract Conditions.~~

~~(8) Termination of the Agreement~~

~~This agreement shall be terminated in the following circumstances.~~

~~(a) The Authority awards the contract for the work to the other Bidder.~~

~~(b) The Authority cancels the work to award the contract.~~

~~(c) On completion of the defect liability period as stipulated in the Contract Agreement of the works and all the liabilities thereof are liquidated.~~

~~(9) No partner has right to assign any benefits, obligation of liability under the agreement to any third party without prior written consent of the other partner as well as Authority.~~

~~(10) Financial matter~~

~~(a) Bank Account in the name of the Joint Venture will be opened with any scheduled or nationalized Bank to be operated by an individual signatory as decided mutually by the Joint Venture partners.~~

~~(b) All the partners shall be responsible to maintain or cause to maintain proper Books of accounts, balance sheet and profit and loss account as to the state of affairs of the firm as at the end of the financial year and as to the profit and loss made or incurred by the firm for the year ended on that date, respectively shall be prepared and the same shall be subject to audit by a Chartered Accountant.~~

~~(c) None of the party shall be entitled to make any borrowing on behalf of the Joint Venture without express prior written consent of the other party.~~

~~(d) Bank guarantee for the application/execution of the work shall be provided jointly~~

~~from a bank acceptable to the Authority.~~

- ~~(11) **Negotiation:** Any negotiation of agreement between the parties hereto and the Authority subsequent to the submission of the tender and prior to award, shall take place only with consent of each of the parties who shall be represented at the such negotiation by one or more representative(s) duly empowered to make such negotiation or agreement.~~
- ~~(12) **Legal jurisdiction:** All questions relating to validity interpretation of this agreement shall be governed by the law of India and shall be subject to jurisdiction of High Court at Ahmedabad.~~
- ~~(13) **Settlement of disputes:** Any dispute in interpretation of any condition mentioned herein shall be referred to an arbitrator/tribunal by mutual consent of the partners and such proceedings shall be governed by Gujarat Public Works contract disputes tribunal act of 1992 and as amended from time to time. The award of arbitrator shall be final and binding on the party hereto. Neither the obligation of each party hereto the performance of contract nor the execution of work shall stop during the course of arbitration proceeding or as a result thereof.~~
- ~~(14) **Insurance**~~
- ~~(a) The Joint Venture through the parties individually shall take such insurance in connection with the work in accordance with the tender condition acceptable to the Authority.~~
- ~~(b) The cost of the insurance premium paid by the Joint Venture shall be borne and paid by the parties in proportion to their respective shares of work. Other insurance taken individually by the parties shall be fully borne by the respective parties.~~
- ~~(15) No change shall be made this agreement without prior written consent of the Authority and other party. However the Authority directs the parties to make changes in the agreement so as to fulfil tender conditions the parties discuss with Authority and mutually agreed such changes required to be made in the agreement.~~
- ~~(16) **Default and withdrawal from the Joint Venture:** in case that either party fails to observe the provision stipulated in this agreement withdrawal from the Joint Venture, Loss and/or expenses incurred by other party due to such default and/or withdrawal shall be fully compensated by the party who has defaulted.~~
- ~~(17) All matter relating to or arising due to this agreement shall be treated as confidential and shall not be disclosed to any other party.~~

In witness whereof the parties have caused their duly authorized representatives to sign below.

Signed for and on behalf of Firm-A

Date-

Seal & Sign

Witness

Signed for and on behalf of Firm-B

Date-

Seal & Sign

Witness

ANNEXURE-D

Medical Gas Pipeline System (MGPS)

MANUFACTURER'S AUTHORISATION FORM

To,
Chief Engineer,
PIU, Gandhinagar

Ref: Your TE document No _____ dated _____

We, _____ who are proven and reputable manufacturers of _____ (name and description of the goods offered in the tender) having factories at _____, hereby authorize Messrs. _____ (name and address of the agent) to submit a tender, process the same further and enter into a contract with you against your requirement as contained in the above referred TE documents for the above goods manufactured by us.

We also state that we are not participating directly in this tender for the following reason(s):

_____ (please provide reason here).

We also hereby extend our full warranty, CMC as applicable as per clause of the tender documents, read with modification, if any, in the Special Conditions of Contract for the goods and services offered for supply by the above firm against this TE document.

We also hereby confirm that we would be responsible for the satisfactory execution of contract placed on the authorized agent

We also confirm that the price quoted by our agent shall not exceed the price which we would have quoted directly"

Yours faithfully, [Signature with date, name and designation] for and on behalf of Messrs _____
[Name & address of the manufacturers]

Note: 1. This letter of authorization should be on the letter head of the manufacturing firm and should be signed by a person competent and having the power of attorney to legally bind the manufacturer. 2. Original Letter may be sent. Photocopy not acceptable

ANNEXURE - II

Medical Gas Pipeline System (MGPS)

Declaration / Undertaking on Letter Head

I/We.....Resident of (Address) do solemnly pledge and affirm That I am the proprietor/partner/authorized.....signatory of M/S.....hereby giving assurance that we will supply and install all medical gas pipeline system, as per referenced standard (NAME OF PARTICULAR STANDARD TO BE MENTIONED, i.e. HTM-02-01 / NFPA 99 / DIN ISO 7396) and corresponding tender technical specifications and items incorporated in this tender documents and material, equipment, accessories are meeting the quality standards accordingly to relevant IS / ASTM / BIS and relevant standards and technical specifications.

Name, Signature & Address of the tenderer

With Stamp

ANNEXURE-III
Medical Gas Pipeline System (MGPS)

MOU

Memorandum of Understanding between bidder and nominated sub-contractor for MGPS

This Memorandum of Understanding (MOU) made on Date----- between M/S (Name of the bidder) having their registered office (hereinafter called the "Bidder") and Sub-contractor (Here after called nominated sub-contractor) is a Bonafide experienced Civil Contractor of sound financial standing and reputation fulfilling the requirements, specifications and mandatory and special conditions mentioned in tender document to take up the work of **New construction of PHC Main Building, PM Room, Compound Wall, C.C. Road and Electrical Work at Fulay, Ta:- Nakhatrana, Dist:- Kutch.** Whereas Nominated Sub-contractor (Name and address of Nominated sub-contractor) is a Bonafide medical gas Contractor of sound financial standing and reputation fulfilling the requirement to take up the Medical Gas works.

And whereas Bidder and Nominated sub-contractor having recognized their strengths of each other's unique position and having felt it necessary to enter into this Memorandum of Understanding

Nominated Sub-contractor having experience of SITC of MGPS work as per standard HTM-02-01 / NFPA 99 / DIN-ISO 7396 and specification.

NOW THEREFORE THIS DEED WITNESSED AS UNDER:

Nominated sub-contractor (Name and address of nominated sub-contractor) i.e. the "Associates" for Medical Gas works has shown their interest to quote for the Medical Gas works.

The "Bidder" and the Nominated sub-contractor shall fulfil the Mandatory Pre-qualifications criteria and also submit all the mandatory documents as per PQ criteria,

This Memorandum of Understanding should not be construed as deed of partnership and shall be governed by applicable laws in India.

Dated this

For _____ For

(Name and address of Bidder) _____ (Name and address of Nominated Sub Contractor)

Position: _____ Position:

ANNEXURE-IV
Central Sterile Supply Department (CSSD)

(Technical Compliance)

Should be duly certified by the Manufacturer

Sr no	Description of items as per technical specification	Compliance Yes/ No	Deviation	Make Quoted

ANNEXURE-V

Central Sterile Supply Department (CSSD)

(Agreement for Supply of Spares)

AGREEMENT

This Agreement entered into at _____ Between M/s. _____
_____ (Name of Bidder) _____ having its registered office at _____

AND

M/s. _____ (Name of Supplier) _____ having its registered
office at _____.

~~WHEREAS the first party is the bidder and the Second Party is the Supplier.~~

~~NOW THIS AGREEMENT WITNESSETH AS UNDER AGREED BY AND BETWEEN THE PARTY
HERETO:~~

~~1. _____ The Second Party hereby agrees to supply spares to First Party for a period of 10 Years
from the date of final commissioning for Central Sterile Service Department.~~

SIGNATURE:

FIRST PARTY

SECOND PARTY

**(~~*Should be duly notarized by the Notary Authority of the Country of Origin of Bidder
and Supplier~~)**

ANNEXURE-VI

Central Sterile Supply Department (CSSD)

MANUFACTURER'S AUTHORISATION FORM

Chief Engineer,
PIU, Gandhinagar

Ref: Your TE document No _____ dated _____

We, _____ who are proven and reputable manufacturers of _____ (name and description of the goods offered in the tender) having factories at _____, hereby authorize Messrs _____ (name and address of the agent) to submit a tender, process the same further and enter into a contract with you against your requirement as contained in the above referred TE documents for the above goods manufactured by us.

We also state that we are not participating directly in this tender for the following reason(s):
_____ (please provide reason here).

We also hereby extend our full warranty, CMC as applicable as per clause of the tender documents, read with modification, if any, in the Special Conditions of Contract for the goods and services offered for supply by the above firm against this TE document.

We also hereby confirm that we would be responsible for the satisfactory execution of contract placed on the authorized agent

We also confirm that the price quoted by our agent shall not exceed the price which we would have quoted directly"

Yours faithfully, [Signature with date, name and designation] for and on behalf of
Messrs. _____ [Name & address of the manufacturers]

Note: 1. This letter of authorization should be on the letter head of the manufacturing firm and should be signed by a person competent and having the power of attorney to legally bind the manufacturer. 2. Original Letter may be sent. Photocopy not acceptable

ANNEXURE-VII
Central Sterile Supply Department (CSSD)

MOU

~~Memorandum of Understanding between bidder and nominated sub-contractor for CSSD~~

~~This Memorandum Of Understanding (MOU) made on Date----- between M/S (Name of the bidder) having their registered office ----- (hereinafter called the "Bidder") and Sub contractor (Here after called nominated sub-contractor) is a Bonafide experienced Civil Contractor of sound financial standing and reputation fulfilling the requirements , specifications and mandatory and special conditions mentioned in tender document ----- to take up the work **New construction of PHC Main Building, PM Room, Compound Wall,C.C.Road and Electrical Work at Fulay, Ta:-Nakhatrana, Dist:-Kutch.** Whereas Nominated Sub-contractor (Name and address of Nominated sub-contractor) is a Bonafide medical gas Contractor of sound financial standing and reputation fulfilling the requirement to take up the CSSD.~~

~~And whereas Bidder and Nominated sub-contractor having recognized their strengths of each other's unique position and having felt it necessary to enter into this Memorandum of Understanding~~

~~Nominated Sub-contractor having completed similar standard and nature of CSSD~~

~~NOW THEREFORE THIS DEED WITNESSED AS UNDER:~~

~~Nominated sub-contractor (Name and address of nominated sub-contractor) i.e. the "Associates" for CSSD has shown their interest to quote for the CSSD.~~

~~The "Bidder" and the Nominated sub-contractor shall fulfil the Mandatory Pre-qualifications criteria and also submit all the mandatory documents as per PQ criteria,~~

~~This Memorandum of Understanding should not be construed as deed of partnership and shall be governed by applicable laws in India.~~

Dated this _____

For _____	For _____
(Name and address of Bidder) _____	(Name and address of _____
NominatedSub Contractor)- _____	_____
Position:- _____	Position:- _____

ANNEXURE-VIII (HVAC, Electrical work and ELV WORK)

MOU

**Memorandum of Understanding between bidder and nominated sub-contractor for
HVAC, Electrical and ELV work**

This Memorandum of understanding (MOU) made on Date----- between M/S (name of the bidder) having their registered office ----- (hereinafter called the “Bidder”) and Sub-contractor (Here after called nominated sub-contractor) is a Bonafide experienced Civil Contractor of sound financial standing and reputation fulfilling the requirements, specifications and mandatory and special conditions mentioned in tender document to take up the work of **New construction of PHC Main Building, PM Room, Compound Wall, C.C. Road and Electrical Work at Fulay, Ta: Nakhatrana, Dist: Kutch.** Whereas Nominated Sub-contractor (Name and address of Nominated sub-contractor) is a Bonafide medical gas Contractor of sound financial standing and reputation fulfilling the requirement to take up HVAC, Electrical and ELV works.

And whereas Bidder and Nominated sub-contractor having recognized their strengths of each other's unique position and having felt it necessary to enter into this Memorandum of Understanding

Nominated Sub-contractor having completed similar standard and nature of HVAC, Electrical and ELV works.

NOW THEREFORE THIS DEED WITNESSED AS UNDER:

Nominated sub-contractor (Name and address of nominated sub-contractor) i.e. the “Associates” for HVAC, Electrical and ELV work has shown their interest to quote for HVAC, Electrical and ELV.

The “Bidder” and the Nominated sub-contractor shall fulfill the Mandatory Pre qualifications criteria and also submit all the mandatory documents as per PQ criteria,

This Memorandum of Understanding should not be construed as deed of partnership and shall be governed by applicable laws in India.

Dated this

For _____

For

(Name and address of Bidder) _____ (Name and address of
Nominated Sub-Contractor)

Position: _____

Position: _____

ANNEXURE-IX(HVAC, Electrical work and ELV WORK)

Declaration/ Undertaking on Rs. 300/- non judicial stamp paper notarized affidavit

I/We.....Resident of (Address)do solemnly pledge and affirm:-

That I am the proprietor/partner/authorized signatory of

M/S..... hereby giving assurance
that we will supply and install all ELV system, as per referenced standard (Mention name
of standard) and Corresponding tender technical specifications. There will be no change in
declared standard and tender technical specifications at any time of the project execution.

Name, Signature & Address of the tenderer

With Stamp

ANNEXURE-X (MOT)

MANUFACTURER'S AUTHORISATION FORM

Chief Engineer,
PIU, Gandhinagar

Ref: Your TE document No _____ dated _____

We, _____ who are proven and reputable manufacturers of _____ (name and description of the goods offered in the tender) having factories at _____, hereby authorize Messrs _____ (name and address of the agent) to submit a tender, process the same further and enter into a contract with you against your requirement as contained in the above referred TE documents for the above goods manufactured by us.

We also state that we are not participating directly in this tender for the following reason(s):

_____ (please provide reason here).

We also hereby extend our full warranty, CMC as applicable as per clause of the tender documents, read with modification, if any, in the Special Conditions of Contract for the goods and services offered for supply by the above firm against this TE document.

We also hereby confirm that we would be responsible for the satisfactory execution of contract placed on the authorized agent

We also confirm that the price quoted by our agent shall not exceed the price which we would have quoted directly"

Yours faithfully, [Signature with date, name and designation] for and on behalf of
Messrs. _____ [Name & address of the manufacturers]

Note: 1. This letter of authorization should be on the letter head of the manufacturing firm and should be signed by a person competent and having the power of attorney to legally bind the manufacturer.

2. Original Letter may be sent. Photocopy not acceptable

ANNEXURE XI (MOT)

MOU

~~Memorandum of Understanding between bidder and nominated sub-contractor for MOT~~

~~This Memorandum Of Understanding (MOU) made on Date----- between M/S (Name of the bidder) having their registered office ----- (hereinafter called the "Bidder") and Sub-contractor (Here after called nominated sub-contractor) is a Bonafide experienced Civil-Contractor of sound financial standing and reputation fulfilling the requirements, specifications and mandatory and special conditions mentioned in tender document----- to take up the work of Construction of GMERS Medical College and Hospital, Morbi, Whereas Nominated Sub-contractor (Name and address of Nominated sub-contractor) is a Bonafide Modular-Prefabricated Operation Theater Contractor of sound financial standing and reputation fulfilling the requirement to take up the MOT.~~

~~And whereas Bidder and Nominated sub-contractor having recognized their strengths of each other's unique position and having felt it necessary to enter into this Memorandum of Understanding~~

~~Nominated Sub-contractor having completed similar standard and nature of MOT~~

~~NOW THEREFORE THIS DEED WITNESSED AS UNDER:~~

~~Nominated sub-contractor (Name and address of nominated sub-contractor) i.e. the "Associates" for MOT has shown their interest to quote for the MOT.~~

~~The "Bidder" and the Nominated sub-contractor shall fulfil the Mandatory Pre-qualifications criteria and also submit all the mandatory documents as per PQ criteria,~~

~~This Memorandum of Understanding should not be construed as deed of partnership and shall be governed by applicable laws in India.~~

~~Dated this For-----~~

~~(Name and address of Bidder)----- (Name and address of Nominated Sub Contractor)-~~

~~Position:----- Position:-----~~

ANNEXURE-XII

Declaration / Undertaking on Letter Head for LIFT (To be submitted by bidder/Nominated Sub-Contractor, as may be the case)

_____, am the Partner/Proprietor/Authorized signatory of _____ (Mention name of firm and its complete address) do here by solemnly affirm and declare as under:-

1. That our Firm/company i.e. _____ (Mention name of firm and its complete address) is registered vide Registration No. _____ under the provisions of _____ (mention the name of the Act).-

2. That our Firm/company i.e. (Mention name of firm) has applied in response to the tender for the work of _____ (Name of work)_____.

3. That _____ (Mention name of firm) is eligible to submit the aforesaid proposal as it is not under liquidation, court receivership or similar proceedings.-

4. That _____ (Mention name of firm) has not been barred and/or blacklisted by the Central Government / State Government / or any Government under taking at the time of submission of tender.-

5. That _____ (Mention name of firm) has during the last three years neither failed to perform on any agreement nor was expelled from any project or agreement terminated for any breach by the applicant.-

6. That _____ (Mention name of firm) has no contracts with the state/central government that are in arbitration. (In case some contract (s) are in arbitration give the details of such contract in a schedule to be attached with this affidavit).

**Name, Signature & Address of Tenderer
With Stamp**

ANNEXURE-XIII
MANUFACTURER'S AUTHORISATION FORM

The Chief Engineer,
Project Implementation Unit,
4th Floor, PIU/RDD/NHM Building,
Civil Hospital Campus, Gandhinagar-382012

Dear Sir,

Ref: Your TE document No-

Dated-

We, Who..... are proven and reputable manufacturers of (name and description of the goods offered in the tender) having factories athereby authorize M/s. (name and address of the agent) to submit a tender, process the same further and enter into a contract with you against your requirement as contained in the above referred tender documents for LIFT system products manufactured by us.....

The Bidder /Approved Make Lift OEM agency should have to depute at least one technical person to attend any emergency breakdown during 24x7 period 365 days for hospital & College Building. No extra payment Shall be made for the same.

We also hereby extend our full warranty, as per General conditions of contract, we also hereby confirm that we would be responsible for the satisfactory execution of contract placed on the authorized agent we also confirm that the price quoted by our agent shall not exceed the price which we would have quoted directly"

Yours faithfully,

[Signature with date, name and designation]

For and on behalf of M/s. [Name & address of the manufacturers]

Note: 1. this letter of authorization should be on the letter head of the manufacturing firm and should be signed by a person competent

Annexure-XV
MOU

Memorandum of Understanding between bidder and nominated sub-contractor for LIFT

This Memorandum Of Understanding (MOU) made on Date _____ between M/S (Name of the bidder) having their registered office _____ (hereinafter called the "Bidder") and Sub-contractor (Here after called nominated sub-contractor) is a Bonafede experienced Civil Contractor of sound financial standing and reputation fulfilling the requirements, specifications and mandatory and special conditions mentioned in tender document to take up the _____ (Name of Work) _____.

Whereas Nominated Sub-contractor (Name and address of Nominated sub-contractor) is a Bonafede Lift OEM/Contractor of sound financial standing and reputation fulfilling the requirement to take up the Lift works.

And whereas Bidder and Nominated sub-contractor having recognized their strengths of each other's unique position and having felt it necessary to enter into this Memorandum of Understanding.

Nominated Sub-contractor having completed similar standard and nature of Lift Works.

NOW THEREFORE THIS DEED WITNESSED AS UNDER:-

Nominated sub-contractor (Name and address of nominated sub-contractor) i.e. the "Associates" for Lift works has shown their interest to quote for the Lift works.

The "Bidder" and the Nominated sub-contractor shall fulfil the Mandatory Pre qualifications criteria and also submit all the mandatory documents as per PQ criteria, further I (Bidder) shall abide to submit all the remaining documents specified in special conditions of tender document within one month of issue of work order failing which Department / Employer can take appropriate action as per tender clause and conditions.

The Bidder /Approved Make Lift OEM agency should have to depute at least one technical person to attend any emergency breakdown during 24x7 period 365 days for hospital & College Building. No extra payment Shall be made for the same.

This Memorandum of Understanding should not be construed as deed of partnership and shall be governed by applicable laws in India.

In Witness whereof the parties through their authorized representative have executed those present and common seal of their respective companies on the day, month and year mentioned below.

Dated this

For (Name and address of Bidder)

For (Name and address of nominated Sub-contractor)

Name:-

Address:-

Position:-

ANNEXURE- XVI
FOR LIFT
Declaration / Undertaking on Letter Head

~~I/We.....Resident of (Address) do solemnly pledge and affirm :- That I am the proprietor/partner/authorized signatory of M/S..... hereby giving assurance that we will supply and install all Lift system, as per referenced standard (NAME OF PARTICULAR STANDARD TO BE MENTIONED, i.e. Latest (Amendment) Rules of The Gujarat Lifts and Escalators as the Chief Electrical Inspector and Collector of Electricity Duty, GoG) and corresponding tender technical specifications. There will be no change in declared standard and tender technical specifications at any time of the project execution. Moreover, I/We will execute all the LIFT items as per approved technical specifications.~~

Name, Signature & Address of the tenderer
With Stamp

ANNEXURE- XVII

**Affidavit for appointment of Specialised Agency
(MGPS)**

Date: __/__/__

Subject: ~~Appointment of Specialised Agency for _____ Works~~

Project: _____

~~We Here by Produce affidavit that, We _____ having our registered office at _____ is willing to participate in the upcoming project of _____. As per the Pre-Qualification Criteria Clause _____, we hereby submit this affidavit and confirm that if our Techno-Commercial Bid is found successful and LOA/LOI is issued, we shall submit MOU with prospective sub-contractor or manufacturer or authorised dealer who has specific experience qualifying the clause _____ of the tender document before agreement.~~

~~We understand that if we fail to submit such MOU within specified time as per the affidavit and tender documents, Client has right to take appropriate action including forfeiting the EMD also.~~

Authorized Signatory

ANNEXURE- XVIII

**Affidavit for appointment of Specialised Agency
(MOI)**

Date: __/__/__

Subject: Appointment of Specialised Agency for _____ Works

Project: _____

~~We Here by Produce affidavit that We _____ having our registered office at _____ is willing to participate in the upcoming project of _____. As per the Pre-Qualification Criteria Clause _____, we hereby submit this affidavit and confirm that if our Techno-Commercial Bid is found successful and LOA/LOI is issued, we shall submit MOU with prospective sub-contractor or manufacturer or authorised dealer who has specific experience qualifying the clause _____ of the tender document before agreement.~~

~~We understand that if we fail to submit such MOU within specified time as per the affidavit and tender documents, Client has right to take appropriate action including forfeiting the EMD also.~~

Authorized Signatory

ANNEXURE- XIX

Affidavit for appointment of Specialised Agency
(CSSD)

Date: __/__/__

Subject: Appointment of Specialised Agency for _____ Works

Project: _____

~~We Here by Produce affidavit that We _____ having our registered office at _____ is willing to participate in the upcoming project of _____. As per the Pre Qualification Criteria Clause _____, we hereby submit this affidavit and confirm that if our Techno-Commercial Bid is found successful and LOA/LOI is issued, we shall submit MOU with prospective sub-contractor or manufacturer or authorised dealer who has specific experience qualifying the clause _____ of the tender document before agreement.~~

~~We understand that if we fail to submit such MOU within specified time as per the affidavit and tender documents, Client has right to take appropriate action including forfeiting the EMD also.~~

Authorized Signatory

ANNEXURE- XX

Affidavit for appointment of Specialised Agency
(HVAC)

Date: __/__/__

Subject: Appointment of Specialised Agency for _____ Works

Project: _____

~~We Here by Produce affidavit that We _____ having our registered office at _____ is willing to participate in the upcoming project of _____. As per the Pre Qualification Criteria Clause _____, we hereby submit this affidavit and confirm that if our Techno-Commercial Bid is found successful and LOA/LOI is issued, we shall submit MOU with prospective sub-contractor or manufacturer or authorised dealer who has specific experience qualifying the clause _____ of the tender document before agreement.~~

~~We understand that if we fail to submit such MOU within specified time as per the affidavit and tender documents, Client has right to take appropriate action including forfeiting the EMD also.~~

Authorized Signatory

~~ANNEXURE-XXI~~

Affidavit for appointment of Specialised Agency
(ELV)

Date: __/__/__

Subject: Appointment of Specialised Agency for _____ Works

Project: _____

We Here by Produce affidavit that We _____ having our registered office at _____ is willing to participate in the upcoming project of _____. As per the Pre-Qualification Criteria Clause _____, we hereby submit this affidavit and confirm that if our Techno-Commercial Bid is found successful and LOA/LOI is issued, we shall submit MOU with prospective sub-contractor or manufacturer or authorised dealer who has specific experience qualifying the clause _____ of the tender document before agreement.

~~We understand that if we fail to submit such MOU within specified time as per the affidavit and tender documents, Client has right to take appropriate action including forfeiting the EMD also.~~

~~Authorized Signatory~~

ANNEXURE-XXII

Affidavit for appointment of Specialised Agency
(Electrical)

Date: __/__/__

Subject: Appointment of Specialised Agency for Works

Project: _____

~~We Here by Produce affidavit that We _____ having our registered office at _____ is willing to participate in the upcoming project of _____. As per the Pre-Qualification Criteria Clause _____, we hereby submit this affidavit and confirm that if our Techno-Commercial Bid is found successful and LOA/LOI is issued, we shall submit MOU with prospective sub-contractor or manufacturer or authorised dealer who has specific experience qualifying the clause _____ of the tender document before agreement.~~

~~We understand that if we fail to submit such MOU within specified time as per the affidavit and tender documents, Client has right to take appropriate action including forfeiting the EMD also.~~

Authorized Signatory

ANNEXURE- XXIII

Affidavit for appointment of Specialised Agency
(Lift)

Date: __/__/__

Subject: Appointment of Specialised Agency for Works

Project: _____

~~We Here by Produce affidavit that We _____ having our registered office at _____ is willing to participate in the upcoming project of _____. As per the Pre Qualification Criteria Clause _____, we hereby submit this affidavit and confirm that if our Techno-Commercial Bid is found successful and LOA/LOI is issued, we shall submit MOU with prospective sub-contractor or manufacturer or authorised dealer who has specific experience qualifying the clause _____ of the tender document before agreement.~~

~~We understand that if we fail to submit such MOU within specified time as per the affidavit and tender documents, Client has right to take appropriate action including forfeiting the EMD also.~~

Authorized Signatory

AFFIDAVIT

1. ~~I, the undersigned, do hereby certify that all the statements made in the required attachments are true and correct.~~
2. ~~The undersigned also hereby certifies that neither our firm M/s. _____ have not abandoned any work of Government of Gujarat/Government of India/any Board or Corporation under Government of Gujarat/Government of India nor any contract awarded to us for such works have been rescinded, during last five years prior to the date of this bid.~~
3. ~~The undersigned hereby authorize(s) and request (s) any bank, person, firm or corporation to furnish pertinent information deemed necessary and requested by the Department to verify this statement or regarding any (our) competence and general reputation.~~
4. ~~The Undersigned understands and agrees that further qualifying information may be requested, and agrees to furnish any such information at the request of the Department/ Project implementing agency.~~

(Signed by an Authorized Officer of the Firm)

Title of Officer

Name of Firm

Date

UNDERTAKING

I, the undersigned do hereby undertake that our firm
M/s..... would invest a minimum cash
up to 25% of the value of the work during implementation of the contract.

(Signed by an Authorized officer of the firm)

Title of officer

Name of firm

DATE


Dy. Executive Engineer
Project Implementation Unit
Bhuj - Kutch


Executive Engineer
Project Implementation Unit
Bhuj - Kutch

SECTION - 3

CONDITIONS OF CONTRACT

Conditions of Contract

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CONDITIONS OF CONTRACT

A. GENERAL.

1. Definitions

- 1.1 Terms which are defined in the Contract Data are not also defined in the Conditions of Contract but keep their defined meaning.

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

Compensation Events are those defined in Clause 44 hereunder

The **Completion Date** is the date of completion of the Works as certified by the Engineer in accordance with Sub Clause 55.1

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

The **Contract data** defines the documents and other information which comprise the Contract.

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

The **Contractor's Bid** is the completed Bidding document submitted by the Contractor to the Employer and includes Technical and Financial Bids.

The **Contract Price** is the price stated in the Letter of Acceptance and thereafter as adjusted in accordance with the provisions of the Contract.

Days are calendar days; **months** are calendar months.

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

The **Employer- The Principal Secretary/ Additional Chief Secretary, Health Department**, Employers representative: Chief Engineer, PIU who is overall in charge of the works and contract signing authority.

The Engineer is the person named in the Contract Data (or any other competent person appointed and notified to the contractor to act in replacement of the Engineer) who is responsible for supervising the Contractor, administering the Contract, certifying payments due to the Contractor, issuing and valuing Variations to the Contract, and valuing the Compensations Events under the control of Superintending Engineer.

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

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

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

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

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

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

Site Investigation Reports are those which were included in the Bidding documents and are factual interpretive reports about the surface and subsurface conditions at the site.

Specifications means the Specifications of the works included in the Contract and any modification or addition made or approved by the Engineer.

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

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

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

A **Variation** is an instruction given by the Engineer, which varies the Works.

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

2. Interpretation

- 2.1 In interpreting these Conditions of Contract, singular also means plural, male also means female or neuter and the other way around. Heading have no significance. Words have their normal meaning under the language of the Contract unless specifically defined. The Engineer will provide instructions clarifying queries about Conditions of Contract.
- 2.2 If sectional completion is specified in the Contract Data, references in the Conditions of Contract to the Works, the Completion date, and Intended Completion Date apply to any Section of the Works (other than references to the Completion Date and Intended Completion date for the whole works)
- 2.3 The documents forming the Contract shall be interpreted in the following order of priority
 - (1) Agreement
 - (2) Letter of Acceptance, notice to proceed with works
 - (3) Contractor's Bid

- (4) Contract Data
- (5) Conditions of Contract including Conditions of Contract
- (6) Specifications
- (7) Drawings
- (8) Bills of quantities and
- (9) Any other document listed in the Contract Data as forming part of the Contract.

3. Language and Law

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

4. Engineers Decisions

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

5. Delegation

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

6. Communications

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

7. Sub-Contracting

- 7.1 The Contractor may subcontract any portion of work, up to a limit specified in contract data, with the approval of the engineer but may not assign the Contract without the approval of the Employer in writing. Subcontracting shall not alter the Contractor's obligations. **Sub-contracting of supply or specific items of work is not allowed.**
- 7.2 The sub-contractor must be registered in appropriate class and category for the part of work to be sub contracted.

8. Other Contractors

- 8.1 The Contractor shall cooperate and share the Site with other contractors, public authorities, utilities and the Employer between the dates given in the Schedule of other Contractor. The Contractors shall as refer to in the Contract Data, also provide facilities and services for them as described in the Schedule. The employer may modify the schedule of other contractors and shall notify the contractor of any such modifications.

9. Personnel

- 9.1 The Contractor shall employ the key personnel named in the Schedule of Key Personnel as referred to in the Contract Data to carry out the functions stated in the Schedule or other personnel approved by the Engineer. The Engineer will approve any proposed replacement of key personnel only if their qualifications, abilities, and relevant experience are substantially equal to or better than those of the personnel listed in the Schedule.
- 9.2 If the engineer asks the Contractor to remove a person who is a member of the Contractor Staff or his work force stating the reasons the Contractor shall ensure that the person leaves the Site within seven days and has no further connection with the work in the Contract.

10. Employer's and Contractors Risks

- 10.1 The Employer carries the risk which these Contract states are Employer's risks, and the Contractor carries the risks which these Contracts states are Contractors risk.

11. Employer's Risks

- 11.1 The employer is responsible for the excepted risks which are (a) in so far as they directly affect the execution of the Works, the risks of war, hostilities, invasion, act of foreign enemies, rebellion, revolution, insurrection or military or usurped power, civil war, riot commotion or disorder (unless restricted to the Contractor's employees), and contamination from any nuclear fuel or nuclear waste or radioactive toxic explosive.

12. Contractor's Risks

- 12.1 All risks of loss of or damages to physical property and of personal injury and death which arise during and in consequence of the performance of the Contract other than the excepted risks are the responsibility of the Contractor.

13. Insurance

- 13.1 The Contractor shall provide, in the joint names of the Employer and the Contractor, insurance cover from the Start date to the end of the Defects Liability Period, in the amounts and deductibles stated in the Contract data for the following events which are due to the Contractor's risks:

- (a) Loss of or damage to the works, Plant and materials,
- (b) Loss of or damage to Equipment (Evidence of Equipment insurance to be provide along with PQ Documents.)
- (c) Loss of or damages of property (expect the Works, Plant, Materials and Equipment) in connection with the Contract;and
- (d) Personal injury or death.

- 13.2 Policies and certificates for insurance shall be delivered by the Contractor to the Engineer for the Engineer's approval before the Start Date. All such insurance shall provide for compensation to be payable in the types and proportions of currencies required to rectify the loss or damage incurred.

- 133 If the Contractor does not provide any of the policies and certificates required, the Employer may affect the insurance which the Contractor should have provided and recover the premiums the Employer has paid from payments otherwise due to the Contractor or, if no payment is due, the payment of the premiums shall be a debt due.
- 134 Alterations to the terms of an insurance shall not be made without the approval of the Engineer.
- 135 Both parties shall comply with any conditions of the insurance policies.

For the implementation of above, PIU health has already negotiated the rate with their existing insurance companies through its advisor and hence, contractor is to calculate the insurance premium amount on their price considering rate per month as 0.00025.

The cost insurance to be born the contractor only.

Example for calculation the insurance premium outgo: -

1. At the time of agreement (tender amount X Number of Months X 0.00025) = Total Insurance Amount.
2. At the time of extension tender amount X Number of Month (Extension Months as per approval) X 0.00025 = Total Insurance Amount.
3. In case defect liability period exceeding 12 months that additional premium for the months exceeding 12 months to be calculated as tender amount X Number of Month X 0.00025 = Total Insurance Amount. (i.e. if the defect liability period is 48 months then premium rate will be applicable on 48 months – 12 months = 36 months X 0.00025 = Total additional premium)
4. In case of increase in quantity (Increase Project value), additional quantity amount X Number of Months X 0.00025 = Total Insurance Amount.

Contractor is to bring the insurance premium “Demand Draft” payable at par while signing the agreement, on the name of insurance company as mentioned in the issued and accepted “Letter of Award”, also contractor has to submit

Nothing in this clause limits the obligation, liability or responsibilities of the contractor, under the other terms of the contract or otherwise. Any amounts not insured or not recovered from the insurers shall be borne by the contractor in accordance with these obligation, liability or responsibilities. However, if the contractor fails to effect and keep in force an insurance which is available and which it is required to affect and maintain under the contract, and the other party neither approves the omission nor effects insurance for the coverage relevant to this default, any moneys which should have been recoverable under this insurance shall be paid by contractor only

14. Site Investigation Report

- 14.1 The Contractor in preparing the Bid shall rely on any site Investigation reports referred to in the Contract Data, supplemented by any information available to the Bidder.

15. Queries about the Contract data

- 15.1 The engineer will clarify queries on the Contract Data

16. Contractor to Construct the Works

- 16.1 The Contractor shall construct and install the works in accordance with the specification and Drawings.

17. The Works to be completed by the Intended Completion Date

- 17.1 The Contractor may commence execution of the Works on the Start Date and shall carry out the Works in accordance with the programme submitted by the Contractor, as updated with the approval of the Engineer, and complete them by the Intended Completion date

18. Approval by the Engineer

- 18.1 The Contractor shall submit Specifications and Drawings showing the proposed Temporary works to the Engineer, who is to approve them if they comply with the Specifications and drawings.
- 18.2 The Contractor shall be responsible for design of temporary works.
- 18.3 The Engineer's approval shall not alter the contractor responsibility for design of the Temporary works.
- 18.4 The Contractor shall obtain approval of third parties to the design of the Temporary works where required.
- 18.5 All Drawings prepared by the Contractors for the execution of the temporary or permanent work are subject to prior approval by the Engineer before their use.

19. Safety

- 19.1 The Contractor shall be responsible for the safety of all activities on the Site.

20. Discoveries

- 20.1 Anything of historical or other interest or of significant value unexpectedly discovered on the site is the property of the Employer. The contractor is to notify the engineer of such discoveries and carry out the Engineer's instructions for dealing with them.

21. Possession of the Site

- 21.1 The Employer shall give possession of all parts of the site to the Contractor. If possession of a part is not given by the date stated in the Contract Data the Employer is deemed to have delayed the start of the relevant activities and this will be a Compensation Event.
- 21.2 If within 25% of the time limit of the project, 80% of possession of the site is not handed over to the Contractor, then contractor/ Employer may fore-close the contract. Contractor/Employer has to foreclose the work within as decided by Employer. after lapse of 25%-time limit and after 30 days foreclosure option will be closed.

22. Access to the Site

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

23. Instructions

- 23.1 The Contractor shall carry out all instructions of the Engineer pertaining to works which comply with the applicable laws where the site is located.
- 23.2 The Contractor shall permit the Employer to inspect the Contractor's accounts and records relating to the performance of the Contractor and to have them audited by auditors appointed by the Employer, if so required by the Employer.

24. Disputes

- 24.1 If the Contractor is of the view that a decision taken by the Engineer was either outside the authority given to the Engineer by the Contract or that the decision was wrongly taken, the decision shall be referred to **#Superintending Engineer**(Higher Authority)within 30 days of the notification of the Engineer's decision. If the issue is not resolved, any party can refer the matter for conciliation within 30 days from the decision given by the **#Superintending Engineer**.

24.2

- (a) For the work up to Rs.250 Cr., if any of the parties is not satisfied with the decision of the **#Superintending Engineer**, both the parties have to refer to the Chief Engineer concern for the conciliation process.
- (b) For the work more than Rs.250 Cr., if any of the parties is not satisfied with the decision of the **#Chief Engineer**, both the parties have to refer to ⁷ the **#Secretary, Roads & Building Department, Government of Gujarat** for the conciliation process.

If the dispute is not resolved through the conciliation process, he may refer the dispute to Gujarat Public Works Contract Dispute Arbitration Tribunal. If the Contractor fails to refer a claim / dispute to the Higher Authority within 14 days of the notification of the Engineer's decision, the Contractor shall not be entitled to any additional payment/claim if he doesn't follow the above sequence in stipulated time and he should not stop the work.

25. Procedure for Disputers

- 25.1 The arbitration shall be conducted in accordance with the arbitration procedure stated in the Special Conditions of Contract.

26. Deleted

B. TIME CONTROL

27. Programme

- 27.1 Within the time stated in the Contract Data the Contractor shall submit to the Engineer for approval a Programme showing the general methods, arrangements orders, and timing for all the activities in the works along with monthly cash flow forecast.
- 27.2 An update of the Programme shall be a programme showing the actual progress achieved on each activity and the effect of the progress achieved on the timing of the remaining work including any changes to the sequence of the activities.
- 27.3 The Contractor shall submit to the Engineer, for approval an updated programme at intervals no longer than the period stated in the Contract data. If the Contractor does not submit an updated programme within this period, the Engineer may withhold the amount stated in the Contract data from the next payment after the date on which the overdue programme has been submitted.
- 27.4 The Engineer's approval of the programme shall not alter the Contractor's obligations. The Contractor may revise the programme and submit it to the Engineer again at any time. A revised programme is to show the effect of Variations and Compensations events.

28. Extension of the Intended Completion Date

- 28.1 The Engineer shall extend the Intended Completion Date if a compensation Event occurs or a Variation is issued which makes it impossible for completion to be achieved by the Intended Completion Date without the Contractor taking steps to accelerate the remaining work and which would cause the Contractor to incur additional cost.
- 28.2 The Engineer shall decide whether and by how much to extend the Intended Completion Date within 35 days of the Contractor asking the Engineer for a decision upon the effect of a compensation event or Variation and submitting full supporting information. If the Contractor has failed to give early warning of a delay or has failed to cooperate in dealing with a delay, the delay by this failure shall not be considered in assessing the new Intended Completion Date.
- 28.3 The Engineer shall within 14 days of receiving full justification from the contractor for extension of Intended Completion Date refer to the Employer his decision. The employer shall in not more than 21 days communicate to the engineer the acceptance or otherwise of the Engineer's decision. If the employer fails to give his acceptance, the Engineer shall not grant the extension and the contractor may refer the matter under Clause 24.1

29. Deleted

30. Delays Ordered by the Engineer

- 30.1 The Engineer may instruct the Contractor to delay the start or progress of any activity within the works.

31. Management Meetings

- 31.1 Either the Engineer or the Contractor may require the other to attend a management meeting. The business of a management meeting shall be to review the plans for remaining work and to deal with matters raised in accordance with the early warning procedure.
- 31.2 The Engineer shall record the business of management meetings and is to provide copies of his record to those attending the meeting and to the Employer. The responsibility of the parties for actions to be taken is to be decided by the Engineer either at the management meeting or after the management meeting and stated in writing to all who attended the meeting.

32. Early Warning

- 32.1 The Contractor is to warn the Engineer at the earliest opportunity of specific likely future events or circumstances that may adversely affect the quality of the work, increase the Contract price or delay the execution of works. The Engineer may require the contractor to provide an estimate of the expected effect of the future event or circumstance on the contract price and completion date. The estimate is to be provided by the Contractor as soon as reasonably possible.
- 32.2 The Contractor shall cooperate with the Engineer in making and considering proposals for how the effect of such an event or circumstance can be avoided or reduced by anyone involved in the work and in carrying out any resulting instruction of the Engineer.

#33. Identifying Defects/ Defect liability period

33.1 : Defect liability period: The contractor shall be responsible to make good and remedy at his own expense any defect which may develop or may be noticed before the period mentioned hereunder from the certified date of completion. The Engineer in charge shall give the contractor a notice in writing about the defects and the contractor shall make good the same within 15 days of receipt of the notice. In the case of failure on the part of the contractor, the Engineer-in-charge may rectify or remove or re-execute the work at the risk & cost of the contractor. The Engineer-in-charge shall be entitled to appropriate the whole or any part of the amount of security deposit towards the expenses, if any, Incurred by him in rectification, removal or re-execution. The Defects Liability period shall be asunder....

- (a) For all works costing up to Rs. 50,000 (amount put to tender), the period shall be 3 Months from the certified date of completion.
- (b) For all works costing more than Rs. 50,000 and up to Rs. 1 crore (amount put tender), the period shall be 12 (Twelve) months from the certified date of completion or one monsoon, whichever is later.
- (c) For major projects costing more than Rs. 1 crore, the period shall be 36 Months from the certified date of completion which should include three monsoons.
- (d) For original building works the defect liability period will be 4 years or elapse of 4 monsoon period following date of possession of building taken over by user agency following the certified date of completion, whichever is later. For the purpose of deciding the monsoon period, the 30th September shall be treated as the last date.

33.2 Free maintenance guarantee period for works of building and allied system construction

(a) Deleted

(b) Deleted

- (c) Building and allied system of ~~MCPS, MOT, CSSD, Lift~~, Electrification, ~~ELV~~, Water Supply System, Drainage System, ~~HVAC contractor~~ shall maintain in operational condition by repairing, replacing, renovating of any component of building or allied system above as per mention period Cl.33 (D) also contractor shall deploy the qualified manpower for the operation of the system as per requirement

However, this amount shall be released against fixed deposit or bank guarantee pledged in the name of Executive Engineer after completion certificate of work is issued.

(1) Deleted

(2) Deleted

(3) Deleted

(4) Deleted

further that such interruption and diversion shall be undertaken by the Contractor only with the prior written approval of the Executive Engineer which approval shall not be unreasonably withheld. For the avoidance of doubt, it is agreed that the Contractor shall at all times be responsible for ensuring safe operation of the road.

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

34. Tests

- 34.1 If the engineer instructs the Contractor to carry out a test not specified in the Specification to check whether any work has a Defect and the test shows that it does, the Contractor shall pay for the test and any samples. If there is no defect the test shall be a Compensation Event.
- 34.2 #1% of the amount of work done should be deducted from R.A. Bill of the contractor for testing the quality of material workmanship, irrespective of actual charges. We may allow testing certificates of GERI or Government approved Lab by R&B Department/ PIU.

- 34.3 Agency has to establish testing laboratory on site for the various test to be carried out in the work for this purpose agency shall construct a pukka laboratory building with all facility on site at location specified by the engineer in charge. Penalty as per R&B Circular no. _____ Dt. _____.

35. Correction of defects

- 35.1 The engineer shall give notice to the Contractor of any defects before the end of the defects Liability Period, which begins at Completion and is defined in the contract data. The Defects Liability Period shall be extended for as long as Defects remain to be corrected.
- 35.2 Every time notice of a Defect is given, the Contractor shall correct the notified defect within the length of time specified by the Engineer's notice.

36. Uncorrected

37.

38. Defects

- 38.1 If the Contractor has not corrected a defect within the time specified in the Engineer's notice, the Engineer will assess the cost of having the Defect corrected, and the Contractor will pay this amount.

D. COST CONTROL

39. Bill of Quantities

- 39.1 The bill of Quantities shall contain items for the constructions, installation, testing and commissioning work to be done by the Contractor.
- 39.2 The bill of Quantities is used to calculate the Contract price. The Contractor is paid for the quantity of the work done at the rate in the Bill of Quantities for each item.

40. Change in the Quantities

- 40.1 The Engineer shall have power to make any alterations in or addition to the original specifications , drawings, designs and instructions that may appear to him to be necessary or advisable during the progress of the work and the contractor shall be bound to carry out the work in accordance with any instruction in this connection which may be given to him in writing signed by the Engineer and such alteration shall not invalidate the contract and any additional work which the contractor may be directed to do in the manner above specified as part of the work shall be carried out by the contractor on the same conditions in all respects on which he agreed to do the main work and at the same rate as are specified in the tender for the main work.

Except that when the quantity of any item exceeds the quantity as in the tender by more than 130%, the contractor will be paid for the quantity in excess of 130%, at the rate entered in the SOR of the year during which the excess in quantity is first executed.

41. Variations

- 41.1 All Variations shall be included in updated programmes produced by the Contractor.

42. Payments for Variations

- 42.1 If the additional or altered work includes any class of work for which no rate is specified in this contract, then such class of work shall be carried out as under.

- (i) At the rate derived from the item within the contract which is comparable to the one involving additional or altered class of work; where there are more than one comparable items, the item of the contract which is nearest in comparison with regard to class or classes of the work involved shall be selected and the decision of the Superintending Engineer as to the nearest comparable item shall be final and binding on the contractor.

8.

- (ii) If the rate cannot be derived in accordance with (i) above, such class of works shall be carried out at the rate entered in the Schedule of Rates of the division

for the year in which the tender was received, increased or decreased by the percentage by which the tender amount is more or less as compared to the amount arrived at the rates in the "Schedule of Rates" of the Division in the year in which the tender was received. If the Schedule of rates of the Division does not contain all the items, the percentage increase or decrease of the tender shall be calculated considering such items which were included in the "Scheduled Rates" of the division for the year and for materials consumed on such item the rate to be charged would be the basic rate taken into account for fixing the rate in S.O.R. referred to above.

- (iii) If it is not possible to arrive at the rate from (i) and (ii) above, such class of work shall be carried out at the rate decided by the competent authorities on the basis of detailed rate analysis after hearing the contractor before a Committee of two Superintending Engineers stationed at the same place or the nearest place.
- 422 If the additional or altered work, for which no rate is entered in the "Schedule of Rates" of the Division is ordered to be carried out before the rate is agreed upon, then the contractor shall within seven days of the date of receipt by him of the order to carry out the work, inform the Engineer-in-charge of the rate, which it is his intention to charge for such class of work and if the Engineer in charge does not agree to this rates, he shall by notice in writing be at liberty to cancel his order to carry out such class of work and arrange to carry it out in such manner as he may consider it advisable, provided always that if the contractor shall commence work or incur any expenditure in regard thereof before the rates shall have been determined as lastly herein before mentioned, then in such cases he shall only be entitled to be paid in respect of the work carried out or expenditure incurred by him prior to the date of the determination of the rate as aforesaid according to such rate or rates as shall be fixed by the Engineer-in-charge. In the event of the dispute, the decision of the Superintending Engineer of the Circle shall be final.

Where, however, the work is to be executed according to the designs, drawings and specifications recommended by the contractor and accepted by the competent authority, the alternation above referred to shall be within the scope of such designs, drawings and specifications appended to the tenders.

The time limit for the completion of the work shall be extended in the proportion that the increase in the cost occasioned by alterations bears to the cost of the original work and the certificate of the Engineer-in-charge as to such proportion shall be final and conclusive.

43. Cash Flow Forecasts

- 431 When the programme is updated, the contractor is to provide the engineer with an updated cash flow forecast.

44. Payment certificates.

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

~~442 The Engineer shall check the Contractor's monthly statement within 14 days and certify the amount to be paid to the Contractor after taking in to account any credit or debit for the month in question in respect of materials for the works in the relevant amounts and under conditions set forth in sub-clause 32.3 of the Contract Data (secured Advance).~~

443 The value of work executed shall be determined by the Engineer.

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

445 The value of work executed shall include the valuation of variations and compensation events.

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

45. Payments

451 Payments shall be adjusted for deductions for advance payments, retention, other recoveries in terms of the contract and taxes at source, as applicable under the law. The Employer shall pay the Contractor the amounts certified by the Engineer within 28 days of the date of each certificate.

452 Payment of GST (prevailing rates) on the amount payable under the contract to the Contractor will be made by the Employer. Hence, it is the responsibility of the contractor to pay the GST to the concerned Authority of Government. We should decide policy for estimate base on R&B SOR other than 2024-25 and other RA items and electrical items.

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

46. Compensation events

461 The following are compensation Events unless they are caused by the Contractor:

(a) The Employer does not give access to a part of the Site by the site Possession date stated in Contract data to the Contractor

462 In case of compensation event occurs and it prevents the work being⁸ completed beyond the Intended Completion Date then Authority will approve Extension of Time with eligible contractual price escalation.

47. Tax

471 The rates quoted by the Contractor must be inclusive of all taxes prevailing on due date of bid submission except GST. However, any subsequent changes in the tax structure by Government after due date of bid submission will be compensated (+/-) on availability or submission of actual documentation. Contractor will have to intimate Engineer regarding changes occurred in the tax structure after bid submission. If the contractor fails to provide such information and if any financial obligation may arise due to change in tax structure, same will be recovered from the contractor.

472 GST will be paid separately on the bills. Hence, it is the responsibility of the contractor to pay the GST to the concerned Authority. Ref. 43.2

48. Currencies.

481 All payment shall be made in Indian Rupees.

49. Price Adjustment

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

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

(b) The price adjustment shall be determined during each month from the formula given in the contract data.

(c) Following expressions and meanings during to the work done during each month

R = Total value of work done during the month. It would include the amount of secured advance granted, if any, during the month less the amount of secured advance recovered, if any during the month. It will exclude value for works executed under variations for which price adjustment will be worked separately based on the terms mutually agreed.

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

50. Retention

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

- 502 On Completion of the whole of the Works half the total amount retained is repaid to the Contractor and half when the Defects Liability Period has passed and the Engineer has certified that all Defects notified by the Engineer to the Contractor before the end of this period have been corrected.
- 503 On completion of the whole works, the contractor may substitute retention money with an “on demand” Bank guarantee.

In case, Contractor requests for refund of the Retention Money deducted by the Employer under the provision of this clause, Employer shall consider the said request of the Contractor provided that the refund hereunder shall be made in tranches of not less than 1% (One Percent) of the Contract Price and Contractor furnishes an irrevocable and unconditional Bank guarantee for an equal amount substantially in the format of Bank Guarantee for Performance Guarantee enclosed with SBD and valid up to 60 day beyond the scheduled / extended Defects Liability Period. On completion of the whole works, the contractor has however an option to submit a fresh irrevocable and unconditional Bank Guarantee for an amount equal to 5% of the total value of work executed substantially in the format of Bank Guarantee for Performance Guarantee enclosed with SBD and valid up to 60 days beyond the Defect Liability Period and yet refund the Retention Money Bank Guarantee submitted for refund of Retention Money.

51. Liquidated Damages

- 511 The Contractor shall pay liquidated damages to the Employer at the rate per day stated in the Contract Data for each day that the Completion Date is later than the Intended Completion Date (for the whole works or the milestone as stated in the contract data). The total amount of liquidated damages shall not exceed the amount defined in the Contract Data. The Employer may deduct liquidated damages from payment due to the Contractor. Payment of liquidated damages does not affect the Contractor’s liabilities.
- 512 If the Intended Completion Date is extended after liquidated damages have been paid, the Engineer shall correct any overpayment of liquidated damages by the Contractor by adjusting the next payment certificate. The Contractor shall not be entitled for any interest on the over payment calculated from the date of payment to the date of repayment.
- 513 If the contractor fails to comply with the time for completion as stipulated in the tender, then the contractor shall pay to the employer the relevant sum stated in the Contract Data as Liquidated damages for such default and not as penalty for everyday or part of day which shall elapse between relevant time for completion and the date stated in the taking over certificate of the whole of the works on the relevant section, subject to the limit stated in the contract data.

The employer may, without prejudice to any other method of recovery⁸ deduct the amount of such damages from any monies due or to become due to the contractor. The payment or deduction of such damages shall not relieve

the contractor from his obligation to complete the works on from any other of his obligations and liabilities under the contract.

- 514 If, before the Time for Completion of the whole of the Works or, if applicable any Section, a Taking Over Certificate has been issued for any part of the Works or of a Section, the liquidated damages for delay in completion of the remainder of the Works or of that Section shall, for any period of delay after the date stated in such Taking-Over-Certificate, and in the absence of alternative provisions in the Contract, be reduced in the proportion which the value of the part so certified bears to the value of the whole of the Works or Section, as applicable. The provisions of this Sub-clause shall only apply to the rate of liquidated damages and shall not affect the limit thereof.

~~50~~—Bonus

- ~~501~~—If the contractor achieves completion of the whole of the works prior to the intended Completion Date prescribed in Contract Data the Employer shall pay to the contractor a sum stated in Contract Data as bonus for every completed month **but subjected to maximum amount as stated in Contract Data**; which shall elapse between the date of completion of all items of works as stipulated in the contract, including variations ordered by the Engineer and the time prescribed in Clause17.

- ~~502~~—Bonus shall be paid only to works amounting to above INR 5 crore with time limit of the works is equal or more than 6 months. The bonus would be paid asunder

% of Time Saved	% of Initial Contract Price entitled for Bonus
50 %	5%
40 %	4%
30 %	3%
20 %	2%
10 %	1%
Less than 10%	0%

~~51~~—AdvancePayment.

- ~~511~~—The Employer shall make advance payment (not to be paid less than two installments except in special circumstances for which the reason to be Recorded in writing) to the Contractor of the amounts stated in the Contract Date by the date stated in the Contract Date, against provision by the Contactor of an Unconditional Bank Guarantee in a form and by a bank acceptable to the Employer in amounts and currencies equal to be at least 110%oftheadvancepayment.Theguaranteeshallremaineffectiveuntilthe

~~advance payment has been repaid, but the amount of the guarantee shall be progressively reduced by the amounts repaid by the Contractor. The Mobilization advance would be deemed as interest bearing advance at an interest rate of 10 % to be compounded, quarterly.~~

~~512 The Contractor is to use the advance payment only to pay for Equipment, plant and Mobilization expenses required specifically for execution of the Works. The Contractor shall demonstrate that advance payment has been used in this way by supplying copies of invoices or other documents to the engineer.~~

~~513 The advance payment shall be repaid by deduction proportionate amount from payments otherwise due to the Contractor, following the schedule of completed percentages of the Works on a payment basis. No account shall be taken of the advance payment or its repayment in assessing valuations of work done, variations, price adjustments, Compensation Events, or Liquidated damages.~~

514 Deleted

52. Securities

52.1 The performance Security (including additional security for unbalanced bids) shall be provided to the Employer no later than the date specified in the Letter of Acceptance and shall be issued in an amount and form and by a bank or surety acceptable to the Employer, and denominated in Indian Rupees. The performance Security shall be valid until a date
60 days from the certified date of completion of the project and the additional security

for unbalanced bids shall be valid until a date
28 days from the date of issue of the certificate of completion of the work.

Performance and Additional Performance Security shall become refundable/releasable within 15 days after project certified completion date subject to fulfillment of contractual obligation and settlement of all dues and claims.

53. Deleted

54. Cost of Repairs.

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

E. FINISHING THE CONTRACT

55. Completion

- 55.1 The Contractor shall request the Engineer to issue a Certificate of Completion of the works and the Engineer will do so upon deciding that the work is completed.

56. Taking Over

- 56.1 The Employer shall take over the Site and the Works within seven days of the Engineer issuing a certificate of Completion.

57. Final Account

- 57.1 The Contractor shall supply to the Engineer a detailed final account of the total amount that the Contractor considers payable as full and final settlement of all claims under the Contract for items before the end of the Defects Liability Period. The Engineer shall issue a Defect Liability Certificate and certify any final payment that is due to the Contractor within 56 days of receiving the Contractor's account if it is correct and complete. If it is not, the Engineer shall issue within 56 days a schedule that states the scope of the corrections or additions that are necessary. If the Final Account is still unsatisfactory after it has been resubmitted, the Engineer shall decide on the amount payable to the Contractor and issue a payment certificate, within 56 days of receiving the Contractor's revised account.
- 57.2 If reversal in characteristic of tender (L1 becoming L2) on account of excesses and savings in final account is observed, the Engineer/Employer shall be at liberty to restrict the final payment of BOQ items to the lowest amount evaluated of the bids considering the final quantities and the rates quoted including the rebates if any. Payment of variation items shall however be made at the rates approved by the Employer, within 90 days from the physical completion of work.(Applicable for item rate tender only)

Operating and Maintenance Manuals

- 57.3 If "as built" drawings and/or operating and maintenance manuals are required, the Contractor shall supply them by the dates stated in the Contract data.
- 57.4 If the Contractor does not supply the Drawings and/or manuals by the dates stated in the Contract data, or they do not receive the Engineer's approval, the Engineer shall withhold the amount stated in the Contract Data from payments due to the Contractor.

58. Termination

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

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

1. The contractor stops work for 28 days when no stoppage of work is shown on the current programme and the stoppage has not been authorized by the Engineer
2. The Engineer instructs the Contractor to delay the progress of the Works and the instructions is not withdrawn within 28days;
3. The Employer or the Contractor is made bankrupt or goes into liquidation other than for a reconstructions or a amalgamation
4. A payment certified by the Engineer is not paid by the Employer to the Contractor within 56 days of the date of the Engineer's certificate
5. The Engineer gives Notice that failure to correct a particular Defect is a fundamental breach of Contract and the Contractor fails to correct it within a reasonable period of time determined by the Engineer;
6. The Contractor does not maintain a security which is required;
7. The Contractor has delayed the completion of works by the number of days for which the maximum amount of liquidated damages can be paid as defined in the Contract data;and
8. If the Contractor, in the judgment of the Employer has engaged in corrupt or fraudulent practices in competing for or in executing the Contract.

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

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

584 Notwithstanding the above, the employer may terminate the Contract for convenience.

59. Payment upon Termination

59.1 If the Contract is terminated because of a fundamental breach of Contract by the Contractor, the Engineer shall issue a Certificate for the value of the work done less advance payments received up to the date of the issue of the

certificate, less other recoveries due in terms of the contract, less taxes due to deducted at source as per applicable law and less the percentage to apply to the work not completed as indicated in the Contract data. Additional Liquidated Damages shall not apply. If the total amount due to the Employer exceeds any payment due to the Contractor the difference shall be a debt payable to the Employer.

- 592 If the Contract is terminated at the Employer's convenience or because of a fundamental breach of Contract by the Employer, the Engineer shall issue a certificate for the value of the work done, the cost of balance material brought by the contractor and available at site, the reasonable cost of removal of equipment, repatriation of the Contractor's personnel employed solely on the works, and the Contractor's cost of protecting and securing the Works and less advance payment received up to the date of the certificate, less other recoveries due in terms of the contract and less taxes due to deducted at source as per applicable law.

60. Property

- 60.1 All materials on the Site, Plant Equipments, Temporary Works and Works are deemed to be property of the Employer, if the Contract is terminated because of a Contractor's default.

61. Release from Performance

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

F. SPECIAL CONDITIONS OF CONTRACT

62. LABOUR

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

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

63. COMPLIANCE WITH LABOUR REGULATIONS

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

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

SALIENT FEATURES OF SOME MAJOR LABOUR AND OTHER LAWS APPLICABLE TO ESTABLISHMENTS ENGAGED IN BUILDING AND OTHER CONSTRUCTIONS WORK

- A) **Workmen Compensation Act 1923**:- The Act provides for compensation in case of injury by accident arising out of and during the course of employment. 9.
- B) **Payment of Gratuity Act. 1972**:- Gratuity is payable to an employee under the Act on satisfaction of certain conditions on separation if an employee has completed 5 years service or more on death, the rate of 15 days wages for every

completed year of service. The Act is applicable to all establishments employing 10 or more employees.

- C) **Employees P.F. and Miscellaneous Provision Act 1952:-**The Act Provides for monthly contributions by the employer plus workers @ 10% or 8.33% The benefits payable under the Act are:
1. Pension or family pension on retirement or death, as the case maybe.
 2. Deposit linked insurance on the death in harness of the worker.
 3. Payment of P.F. accumulation on retirement/death etc.
- D) **Maternity Benefit Act 1951 :-** The Act provides for leave and some other benefits to women employees in case of confinement or miscarriage etc.
- E) **Contract Labour (Regulation & Abolition) Act 1970:** The Act provides for certain welfare measures to be provided by the Contractor to contract labour and in case the Contractor fails to provide, the same are required to be provided, by the Principal Employer by Law. The principal Employer is required to take Certificate of Registration and the Contractor is required to take license from the designated Officer. The Act is applicable to the establishments or Contractor of Principal Employer, if they employ 20 or more contract labour.
- F) **Minimum Wages Act 1948 :-**The Employer is supposed to pay not less than the Minimum Wages fixed by appropriate Government as per provisions of the Act, if the employment is a scheduled employment. Construction of Building, Roads, Runways are scheduled employment.
- G) **Payments of wages Act 1936:-**It lays down as to by what date the wages are to be paid, when it will be paid and what deductions can be made from the wages of the workers.
- H) **Equal remunerations Act 1979 :-** The Act provides for payment of equal wages for work of equal nature to Male and Female workers and for not making discrimination against female employees in the matter of transfer, training and promotions etc.
- I) **Payments of Bonus Act 1965:-** The Act is applicable to all establishments employing 20 or more employees. The Act provides for payments of annual bonus subject to a minimum of 8.33% of wages and maximum of 20 % of wages to employees drawing Rs. 3500/- per month or less. The bonus to be paid to employees getting Rs, 2500/- per month or above Rs. 3500/- per month shall be worked out by taking wages as Rs.2500/-per month only. The Act does not apply to certain establishments. The newly set-up establishments are exempted for five years in certain circumstances. Some of the State Governments have reduced the employment size from 20 to 10 for the purpose of applicability of this Act.
- J) **Industrial Disputes Act 1947 :-** The Act lays down the machinery and procedure for resolutions of Industrial disputes, in what situations a strike or lock-out becomes illegal and what are the requirements for laying off or retrenching the employees or closing down the establishment.
- K) **Industrial employment (standing Orders) Act 1946 :-** It is applicable to all establishments employing 100 or more workmen (employment size reduced by

some of the State and Central Government to 50). The Act provides for laying down rules governing the conditions of employment by the Employer on matters provided in the Act and get the same certified by the designated Authority.

- L) **Trade Unions Act 1926:-**The Act lays the procedure for registration of trade unions of workmen and employers. The Trade Unions registered under the Act have given certain immunities from civil and criminal liabilities.
- M) **Child Labour (Prohibition & Regulation Act 1986 :-**The Act prohibits employment of children below 14 years of age in certain occupations and process and provides for regulation of employment of children in all other occupations and processes. Employment of Child labour is prohibited in Building and Construction Industry.
- N) **Inter – State Migrant workmen’s (Regulation of Employment & Conditions of service) Act 1979:-**The Act is applicable to an establishment which employs 5 or more inter-state migrant workmen through an intermediary (who has recruited workmen in one state for employment in the establishment situated in another state).The inter-state migrant workmen, is an establishment to which this Act becomes applicable, are required to be provided certain facilities such as housing, medical aid, traveling expenses from home upto the establishment and back, etc.
- O) **The Building and Other Construction workers (Regulation of employment and Conditions of Service) Act 1996 and the Cess Act of 1996:-**All the establishments who carry on any building or other constructions work and employ 10 or more workers are covered under this Act.
All such establishments are required to pay cess at the rate not exceeding 1% of the cost of construction as may be modified by the government. The Employer of the establishment is required to provide safety measures at the Building or construction work and other welfare measures, such as canteens, First Aid facilities, Ambulance, Housing accommodations for workers near the workplace etc. The Employer to whom the Act applies has to obtain a registration certificate from the Registering Officers appointed by the Government.
- P) **Factories Act 1948 :-**The Act lays down the procedure for approval of plans before setting up a factory, health and safety provisions, welfare provisions, working hours, annual earned leave and rendering information regarding accidents or dangerous occurrences to designated authorities. It is applicable to premises employing 10 persons or more with aid of power or 20 or more persons without the aid of power engaged in the manufacturing process.
- Q) **Royalty charges-**The contractor shall pay the royalty to the competent authority as per rule. The **royalty** charges paid shall be borne by the contractor and shall not be reimbursed by the Employer.
- R) **Following Pollution control Acts and amendments made thereof from time to time shall be applicable.**

1. Water (Preservation and control of Pollution) Act,1974
2. Air (Prevention and Control of Pollution Act1981
3. Environmental (Protection) Act1986

The contractor must commit to adopting Environmental management plan for best energy use, waste management, the reduction of pollution as in EMS (Environmental Management system)ISO-14001-2015

64. ARBITRATION (GCC Clause24)

The procedure for arbitration will be as follows: -

24.1 If the Contractor is of the view that a decision taken by the Engineer was either outside the authority given to the Engineer by the Contract or that the decision was wrongly taken, the decision shall be referred to **#Superintending Engineer** (Higher Authority) within 14 days of the notification of the Engineer's decision. If the issue is not resolved, any party can refer the matter for conciliation within 15 days from the decision given by the #Superintending Engineer.

24.2

- (a) For the work up to Rs.250 Cr., if any of the parties is not satisfied with the decision of the #Superintending Engineer, both the parties have to refer to the #Chief Engineer concerned for the conciliation process.
- (b) For the work more than Rs.250 Cr., if any of the parties is not satisfied with the decision of the Chief Engineer, both parties have to refer to the #Secretary, Health Department, Government of Gujarat for the conciliation process.

If the dispute is not resolved through the conciliation process, contractor may refer the dispute to Gujarat Public Works Contract Dispute Arbitration Tribunal. If the Contractor fails to refer a claim / dispute to the Higher Authority within 14 days of the notification of the Engineer's decision, the Contractor shall not be entitled to any additional payment/claim if he doesn't follow the above sequence in stipulated time. However, during such period, he would not stop the work in any case.



**Dy. Executive Engineer
Project Implementation Unit
Bhuj - Kutch**



**Executive Engineer
Project Implementation Unit
Bhuj - Kutch**

SECTION - 4
CONTRACT DATA

#CONTRACT DATA

Clause Reference With respect To section 3

Item marked "N/A" do not apply to this Contract.

1. The Employers is [CL.1.1]
Name: Principal Secretary, Health and Family Welfare Department
Address:
Name of authorized Representative (Chief Engineer, PIU)
2. The Engineer is Superintending Engineer.
Name of Authorized Representative: Executive Engineer
3. The Defects Liability Period is years from the date of completion. [CL.1.1&33]
4. The Start Date shall be 1st days for the date of issue of the Notice to proceed with the work. [CL.1.1]
5. The Intended Completion Date for the whole of the works is [CL.1.1,17&2]
09(Nine) Months after start of work with the following milestones:
Milestone dates: [CL.2.2& 49.1]
Physical works to be completed Period from the start date
Milestone1i.e.%.....days.
Milestone2i.e.%.....days.
Milestone3i.e.%.....days.
Milestone4i.e.%.....days.
6. The Site is located at..... [CL.1.1]
7. The name and identification number of the Contract is: [CL.1.1]
8. The works consist ofwith items as per [CL.1.1]
B.O.Q. The works shall, inter alia, include the following, as Specified or as directed:
(A) Road Works
~~Site clearance; setting – out and layout; widening of existing carriageway and strengthening including camber corrections; construction of new road/ Parallel service road; bituminous pavements remodeling/construction of junctions, intersections, bus bays, lay bays; supplying and placing of drainage Channels, flumes, guard posts and guard other related items; construction/extension of cross drainage works, bridge, approaches and other related stones; protective works for roads/bridge; all aspects of quality assurance of various components of the works; rectification of The defects in the completed works during the Defects Liability Period; submission of "As built" drawings and any other related documents; and other item of work as may be required to be carried out for completing the work in accordance with the drawings and the provisions of the contract and to ensure safety.~~
Delete

(B) Bridge Works

~~Site clearance; setting out, provision of foundations, piers abutments and bearing; prestressed/reinforced cement concrete superstructure; wearing coat, hand railings, expansion joints, approach slabs, drainages spouts/ downtake pipes, arrangements for fixing light posts, water mains, utilities etc; provision of suitably designed protective works; providing wing/return walls; provision of road markings, road signs etc.; all aspects of quality assurance; clearing the site and handing over the works on completion; rectification of the defects during the Defects Liability Period and submission of "As built" drawings and other related documents; and other items of work as may be required to be carried out for completing the works in accordance with the drawings and the provisions of the contract and to Insure safety~~ **Delete**

(C) Building Works

[CL.1.1]

(D) Other Items

Any Other Items as required to fulfill all contractual obligations as per the Bid documents.

10. The following documents also form part of the Contract: [CL.2.3(9)]
As per clause 2-3
11. The law which applies to the Contract is the law of Union of India [CL.3.1]
12. The language of the Contract documents is English [CL.3.1]
13. Limit of subcontracting 25% of the Initial Contract Price [CL.7.1]
14. The Schedule of Other Contractors [CL.8]
15. The Schedule of Key Personnel As per Annex - II to Section I [CL.9]
16. The minimum insurance cover for physical property, injury and death is Rs. 5 lakhs per occurrence with the number of occurrences limited to four. After each occurrence, the contractor will pay an additional premium necessary to make insurance valid for four occurrences always. [CL.13]
17. Site Investigation report [CL.14]
18. The Site Possession dates shall be [CL.21]
19. The period for submission of programme for approval of the engineer shall be 21 days from the issue of Letter of Acceptance. [CL. 27.1]
20. The period between program updates will be days. [CL.27.3]
21. The amount to be withheld for late submission of an updated programme shall be Rs lakhs [CL. 27.3]
22. The following events shall also be Compensation Events [CL. 44]
Substantially adverse ground conditions encountered during the course of execution of work not provided for in the bidding document.
 - (i) ~~Removal of underground utilities detected subsequently~~
 - (ii) ~~Significant changes in classification of soil requiring additional mobilization by the contractor, e.g. ordinary soil to rock excavation,~~
 - (iii) ~~Removal of unsuitable material like marsh, debris dumps, etc. not caused by the contractor.~~

- (iv) ~~Artesian conditions~~
 - (v) ~~Seepage, erosion landslide~~
 - (vi) ~~River training requiring protection of permanent work~~
 - (vii) ~~Presence of historical, archeological or religious structures, monuments interfering with the works~~
 - (viii) ~~Restriction of access to ground imposed by civil, judicial, or military authority~~
23. The currency of the Contract is Indian Rupees [CL. 46]
24. **The formula (e) for adjustment of prices are as under:** [CL.47]
- ~~If any of the commodities like Cement, Steel or Bitumen are not found applicable in a work, the weight component of that commodities {i.e. 'Cement' (Pc), 'Steel' (Ps) or 'Bitumen' (Pb) as indicated in SBD for the purpose of Price Adjustment} shall be clubbed with the weight component of 'Other Material' (Pm), such that the gross % weight of the components shall remain as 100%.~~
- R = value of work as defined in Clause 47.1 of Conditions of Contract

Adjustment for labour component

- (i) ~~Price adjustment for increase or decrease in the cost due to labour shall be paid in accordance with the following formula:~~

$$V_L = \frac{0.85 \times (P_i/100) \times R \times (L_i - L_0)}{L_0}$$

~~V_L = Increase or decrease in the cost of work during the month under consideration due to changes in rates for local labour~~

~~L₀ = The consumer price index for industrial workers for the State on 28 days preceding the scheduled date of opening of technical Bids as published by Labour Bureau, Ministry of Labour, Government of India~~

~~L_i = The consumer price index for industrial workers for the State for the month under consideration as published by the Labour Bureau, Ministry of Labour, Government of India.~~

~~P_i = Percentage of labor component of the work.~~

Adjustment for cement component.

- (ii) ~~Prices adjustment for increase or decrease in the cost of cement procured by the contractor~~

$$V_c = \frac{0.85 \times (P_c/100) \times R \times (C_i - C_0)}{C_0}$$

~~V_c = Increase or decrease in the cost of work during the month under consideration due to changes in rates for cement.~~

~~C₀ = The all India wholesale price index for Ordinary Portland Cement on 28 days preceding the scheduled date of opening of technical bid as published by the Office of the Economic Adviser, Department for Promotion of Industry and Internal Trade, Ministry of Commerce & Industry.~~

~~C_i = The all India average wholesale price index for Ordinary Portland Cement for the month under consideration as published by Office of the Economic Adviser, Department for Promotion of Industry and Internal Trade, Ministry of Commerce & Industry.~~

P_c = Percentage of cement component of the work

Adjustment for steel component

(iii) — Price adjustment for increase or decrease in the cost of steel procured by the contractor shall be paid in accordance with the following formula

$$V_s = 0.85 \times (P_s/100) \times R \times (S_i - S_0)/S_0$$

~~V_s = Increase or decrease in the cost of work during the month under consideration due to changes in the rates for steel~~

~~S₀ = The all India wholesale price index for steel (Mild Steel – Long Products Rebars) on 28 days preceding the date of opening of Bids as published by the Office of the Economic Adviser, Department for Promotion of Industry and Internal Trade, Ministry of Commerce & Industry.~~

~~S_i = The all India average wholesale price index for steel (Mild Steel – Long Products Rebars) for the month under consideration as published by Office of the Economic Adviser, Department for Promotion of Industry and Internal Trade, Ministry of Commerce & Industry.~~

P_s = Percentage of steel component of the work

Note : For the application of this clause, the index of **Mild Steel – Long products Rebars** has been chosen to represent the steel group.

Adjustments of bitumen component

(iv) — Price adjustment for increase in the cost of bitumen shall be paid in accordance with the following formula

$$V_b = 0.85 \times (P_b/100) \times R \times (B_i - B_0)/B_0$$

~~V_b = Increase or decrease in the cost of work during the month under consideration due to changes in rates for bitumen.~~

~~B₀ = The official retail price of bitumen at the IOC depot at the nearest centre on the day 28 days prior to the scheduled date of opening of technical bid.~~

~~B_i = The official price of bitumen of IOC depot at the nearest center:~~

~~For the first 15 days of the month under consideration, the price declared on the 1st day of that month.~~

~~For the remaining days of the month under consideration, the rate declared on the 16th day of that month.~~

10

P_b = Percentage of bitumen component of the work

Adjustment of POL (fuel and lubricant) component

- (v) ~~Price adjustment for increase or decrease in cost of POL (fuel and lubricant) shall be paid in accordance with the following formula~~

$$V_f = 0.85 \times (P_f/100) \times R \times (F_i - F_0)/F_0$$

~~V_f = Increase or decrease in the cost of work during the month under consideration due to changes in rates for fuel and lubricants.~~

~~F₀ = The official retail price of High Speed Diesel (HSD) at the existing consumer pumps of IOC at the nearest centre on the day 28 prior to the date of opening of Bids.~~

~~F_i = The official retail price of HSD at the existing consumer pumps of IOC at the nearest centre for the 15th day of the month of the under consideration.~~

~~P_f = Percentage of fuel and lubricants component of the work~~

~~Note: For the application of this clause, the price of High Speed diesel Oil has been chosen to represent the fuel and lubricants group.~~

Adjustment for Construction Machinery

- (vi) ~~Price adjustment for increase or decrease in the cost of plant and Machinery spare procured by the Contractor shall be paid in accordance with the following formula~~

$$V_p = 0.85 \times (P_p/100) \times R \times (P_i - P_0)/P_0$$

~~V_p = Increase or decrease in the cost of work during the month under consideration due to changes in rates for plant and machinery spares~~

~~P₀ = The all India wholesale price index for **manufacturer of machinery for mining, quarrying and Construction** for the month under consideration as published **Office of the Economic Adviser, Department for Promotion of Industry and Internal Trade, Ministry of Commerce & Industry.**~~

~~P_i = The all India average wholesale price index for **manufacturer of machinery for mining, quarrying and Construction** for the month under consideration as published **Office of the Economic Adviser, Department for Promotion of Industry and Internal Trade, Ministry of Commerce & Industry.**~~

~~P_p = Percentage of plant and machinery spares component of the work.~~

~~Note: For the application of this clause, index of Heavy Machinery and parts has been chosen to represent the Plant and Machinery Spares group~~

Adjustment of other materials Component

(vii) — Price adjustment for increase or decrease in cost of local materials other than cement, steel, bitumen and POL procured by the contractor shall be paid in accordance with the following formula

$$V_m = 0.85 \times (P_m/100) \times R \times (M_i - M_0)/M_0$$

V_m = Increase or decrease in the cost of work during the month under consideration due to change in rates for local materials other than cement, steel, bitumen and POL.

M_0 = The All India wholesale price index (all commodities) on 28 days preceding the scheduled date of opening of technical Bids, as published by the **Office of the Economic Adviser, Department for Promotion of Industry and Internal Trade, Ministry of Commerce & Industry.**

M_i = The All India wholesale price index (all commodities) for the month under consideration as published by the **Office of the Economic Adviser, Department for Promotion of Industry and Internal Trade, Ministry of Commerce & Industry.**

P_m = Percentage of local material components (other than cement, steel, bitumen and POL) of the work.

The following percentage will govern the price adjustment for the entire contract:

	SC	PHC	CHC	Other s
Labour P_l %				
Cement P_c %				
Steel P_s %				
Bitumen P_b %				
POL P_f %				
Plant & Machinery Spares P_p %				
Other Materials P_m %				
Total	100 %	100 %	100 %	100%

Note 1) Delete

2) for new construction of SDH/DH/Medical Colleges and Other building works % shall be applicable as mentioning tender documents.

25. — The proportion of payments retained (retention money) shall be 6% {CL. 48} from each bill subject to a maximum of 5% of final contract price.

10

26. — Amount of Liquidated damages for — For Whole of work {CL.49} delay in completion of works — (1/2000)th of the Initial contract price, rounded off to the nearest

Thousand, per day. For sectional Completion (wherever specified In item 6 of Contract data) (1/2000)th of initial contract price for #5 km Section, rounded off to the nearest thousand per day.

27. ~~Maximum limit of liquidated damages~~ ~~10 percent of the Initial~~ {CL.49}
~~For delay in completion work~~ ~~Contract Price rounded off to~~
~~the nearest thousand~~
28. ~~Amount of Bonus for early completion~~ ~~Amount of bonus for early~~
~~completion of work shall be given~~
~~as per CL.50 of Section 3~~
29. ~~Maximum limit of bonus for early~~ **5 percent** of the Contract {CL. 50}
~~Completion of work~~ ~~Price~~
30. ~~The amount of the advance payment are: {CL. 51 & 52}~~

#Nature of Advances	Amount (Rs.)	Conditions to be fulfilled
i Mobilization	10% of the contract Price	On submission of unconditional Bank Guarantee. (to be drawn before the end of 20% of the contract period). The contractor may furnish four bank guarantees of 2.5 % of each valid for the full period.
ii Equipment	90% for new and 50% of depreciated value for old equipment. Total amount will be subject to a maximum of 5% of the Contract Price	After equipment is brought to site (provided the Engineer is satisfied That the equipment is required for performance of the contract) and on submission of unconditional Bank Guarantee for amount of advance
iii Secured	Deleted	
Advance for		
Non-perish-		
able material		
Brought to site		

(The advance payment will be paid to the Contractor no later than 28 days after fulfillment of the above conditions).

~~31. Repayment of advance payment for mobilization and equipment {CL.51.3}~~

~~The advance loan shall be repaid with percentage deduction from the interim payments certified by the Engineer under the Contract. Deduction shall commence in the next Interim Payment Certificate following that in which the total of all such payments to the Contractor has reached not less than 20 percent of the Contract Price or 6 (six) months from the date of payment of first installment of advance, whichever period concludes earlier, and shall be made at the rate of 20 percent (collectively for both Mobilization Advance and Equipment Advance) of the amounts of all Interim Payment Certificate until such time as the loan has been repaid, always provided that the loan shall be completely repaid prior to the expiry of the original time for completion pursuant to Clause 17 and 28.~~

32. Deleted

33. The securities shall be for the following minimum amounts equivalent {CL. 52}

As a percentage of the Contract Price:

Performance Security for 5 percent of contract price plus Rs. (to be decided after evaluation of the bid) as additional security in terms of ITB Clause 29.5

The standard form of Performance security acceptable to the Employer shall be an unconditional Bank Guarantee of the type as presented in Section 8 of the Bidding Documents.

34. **The Schedule of Operating and maintenance Manuals.....N/A.** {CL.58}

35. The date by which "as- built" drawings (in scale as directed) in 2 sets {CL. 58} are required within 28 days of the issue of certificate of completion of the whole or section of the work, as the case maybe.

36. The amount to be withheld for failing to supply "as built" drawings {CL. 58} by the Date required is Rs Lakhs.

37. The following events shall also be fundamentals breach of contract: {CL.59.2}
"The Contractor has contravened Sub- clause 7.1 and Clause 9 of GCC"

38. The percentage to apply the value of the work not completed representing {Cl 60} the Employer's additional cost for completing the Works shall be 20 percent.


Dy. Executive Engineer
Project Implementation Unit
Bhuj - Kutch


Executive Engineer
Project Implementation Unit
Bhuj - Kutch

SPECIAL, ADDITIONAL CONDITIONS AND PARTICULAR SPECIFICATIONS**SPECIAL CONDITIONS****1 GENERAL**

- 1.1.** The Bidders/Contractors are advised to inspect and examine the site and its surroundings and satisfy themselves with the nature of site, the means of access to the site, the constraints of space for stacking material / machinery, labour etc. constraints put by local regulations, if any, weather conditions at site, general ground/sub soil conditions etc. or any other circumstances which may affect or influence their Bids. The Contractor shall carry out survey of the work area, at his own cost, setting out the layout and fixing of alignment of the building as per architectural and Structural drawings in consultation with the Engineer-in-Charge and proceed further ensuring full structural continuity and integrated and monolithic construction. Any discrepancy between the architectural drawings and actual layout at site shall be brought to the notice of the Engineer-in-charge. It shall be responsibility of the Contractor to ensure correct setting out of alignment using total station instrument. Nothing extra shall be payable on this account. No claims, whatsoever, shall be entertained at a later date for any errors found, on plea that the information supplied by the Department in the Bid is insufficient or is at variance with the actual site conditions.
- 1.2.** The Bidders/Contractors shall, if required by him, before submission of the Bid, inspect the drawings in the Office of the Executive Engineer, Project Implementation Unit, Kutch. The Department shall not bear any responsibility for the lack of knowledge and also the consequences thereof to the Contractor. The information and data shown in the drawings and mentioned in the Bid documents have been furnished, in good faith, for general information and guidance only. The Engineer-in-Charge, in no case, shall be held responsible for the accuracy thereof and/or interpretations or conclusions drawn therefrom by the Contractor and all consequences shall be borne by the Contractor. No claim, whatsoever, shall be entertained from the Contractor, if the data or information furnished in Bid document is different or actual working drawings are at variance with the drawings available for inspection or attached to the Bid documents. It is presumed that the Contractor shall satisfy himself for all possible contingencies, incidental charges, wastages, bottleneck etc. likely during execution of work and acts of coordination, which may be required between different agencies. Nothing extra shall be payable on this account.
- 1.3.** The nomenclature of the item given in the schedule of quantities gives in general the work content but is not exhaustive i.e. does not mention all the incidental works required to be carried out for complete execution of the item of work. The work shall be carried out, all in accordance with true intent and meaning of the specifications and the drawings taken together, regardless of whether the same may or may not be particularly shown on the drawings and/or described in the specifications, provided that the same can be reasonably inferred therefrom. There may be several incidental works, which are not mentioned in the nomenclature of each item but will be necessary to complete the item in all respects. All these incidental works / costs which are not mentioned in item nomenclature but are necessary to complete the item shall be deemed to have been included in the percentage rate quoted by the contractor for various items in the schedule of quantities. No adjustment of rates shall be made for any variation in quantum of incidental works due to variation / change in actual working drawings. Also, no adjustment of rates shall be made due to any change in incidental works or any other deviation in such element of work (which is incidental to the items of work and are necessary to complete such items in all respects) on account of the directions of Engineer-in-Charge. Nothing extra shall be payable on this account.
- 1.4.** The contractor(s) shall give to the local body, police and other authorities all necessary notices etc. that may be required by law and obtain all requisite licenses for temporary obstructions, enclosures etc. and pay all fee, taxes and charges which may be levied on account of these operations in executing the contract. He shall ensure that there is no damage to adjoining property. If any such untoward happens, he shall be entirely responsible for any consequences besides making good any

- 1.5.** Proper temporary barricading by fencing with G.I. sheets, shall be carried out by the Contractor at the start of work to physically define the boundaries of the plot for restricted entry to only those involved in the work and also to prevent any accidents, at the same time without causing any inconvenience to the traffic and the users of the buildings in the adjacent plots. It shall be done by providing, erecting, maintaining temporary protective barricading of minimum 3.0 metres in height, made in panels, with each panel having MS frames / MS scaffolding pipes of suitable size and stiffness, with 24 gauge thick GI corrugated sheet or suitably stiffened plain GI sheet fixed on frames. Such panels shall be suitably connected to each other for stability with nuts and bolts, hooks, clamps etc. and fixed firmly to the ground at about 2 metres spacing, for the entire duration till completion of the work. He shall also provide and erect temporary protective barricades within the plot, if required, to prevent any accident. Temporary protective roofing near the Entrance to the building, under construction, shall be made to protect the visiting officials from getting hurt by falling debris etc. Also, one or more coat of enamel paint of shade as approved and directed by the Engineer-in- Charge shall be applied on the panels and "CPWD" shall be painted over that in suitable sizes, shapes and numbers as directed by the Engineer-in- Charge. It shall be dismantled and taken away by the Contractor after the completion of work at his own cost with the approval of the Engineer -in-Charge. Nothing extra shall be payable on this account.
- 1.6.** The contractor shall maintain the site barricading during the complete period of execution and realign it if required, for execution of works. A penalty of Rs. 50,000/- per day shall be levied for not maintaining the barricading in good condition or breach of any of the above conditions as per the direction of Engineer-in-charge.
- 1.7.** The contractor shall be responsible for the watch and ward / guard of the buildings, safety of all fittings and fixtures including sanitary and water supply fittings and fixtures provided by him against pilferage and breakage during the period of installations and thereafter till the building is physically handed over to the department. No extra payment shall be made on this account.
- 1.8.** Wherever any reference to any Indian Standards occurs in the documents relating to this contract, the same shall be inclusive of all amendments issued thereto or revisions thereof, if any, up to the date of receipt of Bids.
- 1.9.** The Contractor shall establish, maintain and assume responsibility for grades, lines, levels and benchmarks. He shall report any errors or inconsistencies regarding grades, lines, levels, dimensions etc. to the Engineer -in-Charge before commencing work. Commencement of work shall be regarded as the Contractor's acceptance of such grades, lines, levels, and dimensions. If at any time, any error appears due to grades, lines, levels and benchmarks during the progress of the work, the Contractor shall, at his own expense rectify such error, if so required, to the satisfaction of the Engineer -in-Charge. Nothing extra shall be payable on this account for any errors found at a later date.
- 1.10.** The Contractor shall protect and maintain temporary/ permanent benchmarks at the site of work throughout the execution of work. These benchmarks shall be got checked by the Engineer-in-Charge or his authorized representatives. The work at different stages shall be checked with reference to bench marks maintained for the said purpose. Nothing extra shall be payable on this account.
- 1.11.** The approval by the Engineer-in-Charge, of the setting out by the Contractor, shall not relieve the Contractor of any of his responsibilities and obligation to rectify the errors/ defects, if any, which may be found at any stage during the progress of the work or after the completion of the work.
- 1.12.** The Contractor shall be entirely and exclusively responsible for the horizontal, vertical and other alignments, the level and correctness of every part of the work and shall rectify effectively any errors or imperfections therein. Such rectifications shall be carried out by the Contractor at his own cost to the entire satisfaction of the Engineer -in- Charge.
- 1.13.** Geo-technical investigation report of works is available in the office of the Executive Engineer, Project Implementation Unit, Gandhinagar, Palitana. Interested bidders can

go through the report if required for their guidance. However the Bidder is advised to obtain requisite details directly as may be considered necessary by him before quoting rates in the Bid. No claim whatsoever on account of any discrepancy between the sub-surface strata conditions that may be actually encountered at the time of execution of the work and those available in the report shall be entertained under any circumstances. The ground water table is a variable condition and the information given in the report is only indicative and it may vary from time to time.

- 1.14.** Any legal or financial implications resulting out of disposal of earth shall be sole responsibility of the contractor. Nothing extra over the schedule shall be paid on this account.
- 1.15.** Wherever required for the execution of work, scaffolding shall be provided and suitably fixed, by the Contractor. The contractor shall provide steel double scaffolding system, suitably braced for stability, with all the accessories, gangways, etc. with adjustable suitable working platforms to access the areas with ease for working and inspection. It shall be designed to take all incidental loads. It should cater to the safety features for workmen. Nothing extra shall be payable on this account. It shall be ensured that no damage is caused to any structure due to the scaffolding.
- 1.16.** The Contractor shall carry out his work so as not to interfere with or hinder the progress of the work being performed by other Contractors or by the Engineer-in-Charge. As far as possible, he shall arrange his work and place, so as not to interfere with the operations of other Contractors or shall arrange his work with that of the others, in an acceptable and coordinated manner and shall perform it in proper sequence to the complete satisfaction of Engineer in charge.
- 1.17.** He shall protect and indemnify the PROJECT IMPLEMENTATION UNIT and its officials & employees against any claim and /or liability arising out of violations of any such laws, ordinances, orders, decrees, by himself or by his employees or his authorized representatives. Nothing extra shall be payable on these account.
- 1.18.** The Contractor shall assume all liability, financial or otherwise in connection with this contract and shall protect and indemnify the Department from any and all damages and claims that may arise on any account. The Contractor shall indemnify the Department against all claims in respect of patent rights, royalties, design, trademarks of name or other protected rights, damages to adjacent buildings, roads or members of public, in course of execution of work or any other reasons whatsoever, and shall himself defend all actions arising from such claims and shall indemnify the Department in all respect from such actions, costs and expenses. Nothing extra shall be payable on this account
- 1.19.** The labour huts shall be erected on the plot as marked by PIU and the Contractor shall make his own arrangements to provide such accommodation as per the rules of the local bodies and PIU/ Relevant Specification/Relevant Codes/ Relevant Circular/CPWD. He shall make his own arrangements for stores, field office etc. Before Bidding, he shall visit the site and assess the manner in which he is able to arrange the above facilities. The Engineer-in-Charge shall in no way be responsible for any delay on this account and no claim, whatsoever, on this account shall be entertained. Nothing extra shall be payable on this account.
- 1.20.** The Contractor shall display all permissions, licenses, registration certificates, bar charts, other statements etc under various labour laws and other regulations applicable to the works, at his site office.
- 1.21.** No tools and plants including any special T&P etc. shall be supplied by the Department and the Contractor shall have to make his own arrangements at his own cost. No claim of hindrance (or any other claim) shall be entertained on this account.
- 1.22.** The Contractor shall take all precautions to abide by the environmental related restrictions imposed by any statutory body having jurisdiction in the Palitana (Odisha) as well as prevent any pollution of streams, ravines, river bed, Sub-soil, water table, sea and waterways etc. All waste or superfluous materials shall be transported by the Contractor, and disposed off at designated places only. No claim on account of site constraints mentioned above or any other site constraints such as lack of public transport, inadequate availability of skilled, semi-skilled or unskilled workers in the near vicinity, non-availability of construction machinery spare parts etc. or any other constraints not specifically stated here shall be entertained from the Contractor. Therefore, the Bidders are advised to visit site and get first-hand information of site constraints. Accordingly, they should quote their Bids. Nothing extra shall be payable on this account. Any hindrances claimed by the contractor on this account

shall not be considered while giving extension of time under clause 5 of General condition of contract amended up to date till last date or extended last date of submission of Bid.

1.23. Other agencies will also simultaneously execute and install the works of other civil and E&M services for the work and the contractor shall afford necessary facilities for the same. The contractor shall leave such recesses, holes, openings, trenches etc. as may be required for such related works and the contractor shall fix the same at time of casting of concrete, stone work and brick work, if required, and nothing extra shall be payable on this account.

1.24. HVAC agency will also simultaneously install ducting work and the contractor shall adjust work schedule of false ceiling accordingly and afford necessary facilities for the same. Claims of the contractor for damage to false ceiling by HVAC agency will not be entertained under any circumstances and he should resolve dispute, if any, amicably.

1.25. On completion of work, the contractor shall submit required sets of "as built" drawings to the Engineer-In-Charge furnishing requisite information for obtaining various service connections. The contractor shall be responsible for obtaining "No Objection Certificate" from the local development authorities in respect of services covered in the scope of his contract.

1.26. The Contractor(s) shall take all precautions to avoid accidents by exhibiting necessary caution boards day and night. The contractor shall ensure entire necessary precaution during the entire period of work and site related activities to ensure full safety to workers and avoid any kind of accident. In case of any accident of labours/ contractual staffs or any other human being the entire responsibility will rest on the part of the contractor both legally and financially and any compensation under such circumstances, if becomes payable, shall be entirely borne by the contractor. Existing drains, pipes, cables, overhead wires, sewer lines, water lines and similar services encountered in the course of the execution of work shall be protected against the damage by the contractor, at his own expense, for which nothing is payable. The contractor shall not store materials or otherwise occupy any part of the site in a manner likely to hinder the operation of such services.

1.27. The work shall generally be carried out in accordance with the "PIU/ Relevant Specification/Relevant Codes/ Relevant Circular/CPWDs 2009 Vol.I & II" with up to date correction slips, additional/Particular Specifications, architectural/Structural drawings and as per instructions and approval of Engineer-in-Charge. Any additional item of the work, if taken up subsequently, shall also conform to the relevant PIU/ Relevant Specification/Relevant Codes/ Relevant Circular/CPWDs as mentioned above.

1.28. Unless otherwise specified, PIU/ Relevant Specification/Relevant Codes/ Relevant Circular/CPWDs 2009 volume I & II with up to date corrections slips shall be followed in general. Any additional item of work, if taken up subsequently, shall also conform to the relevant PIU/ Relevant Specification/Relevant Codes/ Relevant Circular/CPWDs mentioned above. Should there be any difference or discrepancy between the description of items as given in the schedule of quantities, particular specifications for individual items of work (including special conditions) and I.S. Codes etc., the order of preference given in Para 1.9 of Special Conditions of Contract of General Conditions amended up to date shall be observed.

1.29. The several documents forming the Bid are to be taken as mutually complementary to each other another. Detailed drawings shall be followed in preference to small scale drawings and figured dimensions in preference to scale dimensions.

1.30. Should there be any difference or discrepancy between the description of items as given in the schedule of quantities, particular specifications for individual items of work (including special conditions) and I.S. Codes etc., the following order of preference shall be observed.

a) Description of items as given in Schedule of quantities

b) Particular specifications

c) Special conditions

d) Additional Conditions

e) PIU/ Relevant Specification/Relevant Codes/ Relevant Circular/CPWDs including up to date correction slips.

f) General Condition of Contract for CPWD works including correction slips issued up to last date of submission of bid.

g) Indian Standards Specifications of B.I.S.

h) ASTM, BS, or other foreign origin code mentioned in Bid document.

i) Manufacturer's specifications and as decided by the Engineer-in- Charge.

j) Sound Engineering practices or well established local construction practices.

1.31. The works to be governed by this contract shall cover delivery and transportation up to destination, safe custody at site, insurance, erection, testing and commissioning of the entire works.

The work to be undertaken by the contractor shall inter-alia include the following:

- a) Preparation of detailed SHOP drawings and AS BUILT drawings wherever applicable.
- b) Obtaining of Statutory permissions where-ever applicable and required.
- c) Pre-commissioning tests as per relevant standards specifications, code of practice, Acts and Rules wherever required.
- d) Warranty obligation for the equipments and / or fittings/fixtures supplied by the contractor. Contractor shall provide all the shop drawings or layout drawings for all the co-ordinated services before starting any work or placing any order of any of these services etc. These shop drawings/layout drawings shall be got approved from Engineer-in-charge before implementation and this shall be binding on the contractor. The contractor shall submit material submittals along with material sample for approval of Engineer-in-Charge prior to delivery of material at site.

1.32. The work shall be carried out in accordance with the Architectural drawings and structural drawings, to be issued from time to time, by the Engineer-in-Charge. Before commencement of any item of work, the contractor shall correlate all the relevant architectural and structural drawings issued for the work and satisfy himself that the information available therefrom is complete and unambiguous. The discrepancy, if any, shall be brought to the notice of the Engineer-In-Charge before execution of the work. The contractor alone shall be responsible for any loss or damage occurring by the commencement of work on the basis of any erroneous and/or incomplete information. No claim whatsoever shall be entertained in the account.

1.33. Unless otherwise provided in the Schedule of quantities the rates Bided by the contractor shall be all inclusive and shall apply to all heights, lifts, leads and depths of the building and nothing extra shall be payable to him on this account.

1.34. The Contractor(s) shall take instructions from the Engineer-in-Charge regarding collection and stacking of materials at any place. No excavated earth or building rubbish shall be stacked on areas where other buildings, roads, services and compound walls are to be constructed. The stacking shall take place as per stacking plan however, if any change is required, the same shall be done with the approval of Engineer-in-Charge.

1.35. The contractor shall engage specialized agency for carrying out specialized item such as Structural glazing, stone cladding, interior works, Aluminium works etc. as mentioned in the Bid document covered under the schedule of Quantity for Civil component. Before engaging such agency, the contractor shall submit for the approval of Engineer-in-charge, the name of the agency along with their working experience, presentation on method statement and materials being used for execution of such items etc.

1.36. The Contractor shall bear all incidental charges for cartage, storage and safe custody of materials, if any, issued by department as well as to those materials also arranged by the contractor.

1.37.

1.38. Any cement slurry added over base surface for continuation of concreting for better bond is deemed to have been built in the items or on the base surface of monolithic RCC work for better bond and nothing extra shall be payable or extra cement considered in consumption on this account,

1.39. Water tanks, taps, sanitary, water supply & drainage pipes, fittings & accessories should conform to bye-laws of local body/corporation, where PIU/ Relevant Specification/Relevant Codes/ Relevant Circular/CPWDs are not available. The Contractor should engage approved, licensed plumbers for the work and get the materials (fixtures/fittings) tested, by the municipal Body/ Corporation authorities wherever required at his own cost. The Contractor shall submit for the approval of the Engineer-in-Charge, the name of the plumbing agency (along with their working experience in recent

past) proposed to be engaged by him.

- 1.40.** The contractor shall make his own arrangements for water and for obtaining electric connections if required and make necessary payments directly to the State Govt. departments concerned. Contractor shall get the water tested from laboratory approved by the Engineer-in-charge at regular interval as per the PIU/ Relevant Specification/Relevant Codes/ Relevant Circular/CPWDs 2009. All expenses towards collection of samples, packing, transportation etc. shall be borne by the contractor. Agency shall neither be allowed to use existing borewell, if any, nor allowed to dig any borewell in the site premises without specific permission from the concerned Govt. authority. The contractor shall install water treatment plant at site and treat the water to obtain the desired parameter of water quality required for construction as per relevant IS codes.
- 1.41.** The agency shall give performance test of the entire installation(s) as per the specifications in the presence of the Engineer-in-charge or his authorized representative before the work is finally accepted and nothing extra what-so-ever shall be payable to the agency for the test.
- 1.42.** The work of services will be executed simultaneously. The agency shall minimize the scope of making recesses, holes, opening etc. as the same shall be planned and necessary grooves/niches shall be provided in shuttering of RCC.
- 1.43.** The agency shall conduct his work, so as not to interfere with or hinder the progress or completion of the work being performed by other agency(s) or by the Engineer-in-Charge and shall as far as possible arrange his work and shall place and dispose of the materials being used or removed, so as not to interfere with the operations of other agency simultaneously working or he shall arrange his work with that of the others in an acceptable and coordinated manner and shall perform it in proper sequence to the complete satisfaction of others.
- 1.44.** If the work is carried out in more than one shift or during night, no claim on this account shall be entertained. The agency must take permission from the police authorities etc. if required for work during night hours, no claim / hindrance on this account shall be considered if work is not allowed during night time.
- 1.45.** The agency shall be responsible for the watch and ward / guard of the buildings safety, fittings and fixtures provided by him against pilferage and breakage during the period of installations and thereafter till the building is physically handed over to the department. No extra payment shall be made on this account.
- 1.46.** Sample of building materials, fittings and other articles required for execution of work shall be got approved from the Engineer-in-Charge before use in the work. The quality of samples brought by the agency shall be judged by standards laid down in the relevant CPWD/ BIS specifications. All materials and articles brought by the agency to the site for use shall conform to the samples approved by the Engineer-in-Charge which shall be preserved till the completion of the work.
- 1.47.** BIS marked materials except otherwise specified shall be subjected to quality test at the discretion of the Engineer-in-Charge besides testing of other materials as per the specifications described for the item/material. Wherever BIS marked materials are brought to the site of work, the agency shall, if required, by the Engineer-in-Charge, furnish manufacturer's test certificate or test certificate from approved testing laboratory to establish that the material / procured by the agency for incorporation in the work satisfies the provisions of specifications / BIS codes relevant to the material and / or the work done.
- 1.48.** The agency shall procure the required materials in advance so that there is sufficient time to testing of the materials and clearance of the same before use in the work. The agency shall provide at his own cost suitable weighing and measuring arrangements at site for checking the weight / dimensions as may be necessary for execution of work.
- 1.49.** Regarding testing of civil & electrical materials, the testing of materials shall be conducted in Govt. Laboratory/ Govt. colleges/ IITs/NITs or from the laboratory approved by Engineer-in-charge. The charges of testing of materials in approved laboratory shall be borne by the agency.
- 1.50.** All necessary approvals required for tree cutting, shall be taken by the Agency. The compensation fee, cost of compensatory plantation or any other such fee payable to Government Body shall be reimbursed to the Agency by PIU. However, the efforts shall be made to Transplant maximum trees on the site in consultation with Forest Department. The cost of transplantation shall be borne by the agency.
- 1.51.** The bidder/contractor shall impart training to at least 10% of the unskilled workers to

semi skilled/skilled category, as per office memorandum No. 14/10/2018-S&D/387 dated 31/08/2018 issued by Director (S&D), CPWD, New Delhi.

- 1.52.** Entire work under the scope of composite bid including major and all minor components shall be executed under one agreement and shall be opened for inspection of CTE/Quality Control & Third Party Quality Assurance appointed by the department. (As per CSQ Memorandum No. CE(CSQ)/SE(QA)/G-III/651 dt. 01.01.2015).

1.53. FACILITIES FOR THE DEPARTMENT

- a) The Agency shall construct site office (semi-permanent structure) for PIU officers and staff, which should be equipped with all necessary equipments required for functioning the office. The area of this office should not be less than 300 Sqm with pantry, conference room, toilets and other requisite facilities. A proposal of site office shall be submitted by the agency 15 days after award of work and the same should be constructed and made functional within 45 days after approval of PIU.
- b) The office should have vitrified tile in common areas and rooms with UPVC / Aluminium windows and laminated flush door shutters. The toilet fixtures and specifications are to be as per PIU/ Relevant Specification/Relevant Codes/ Relevant Circular/CPWD and approved by Engineer-in-Charge.
- c) The Agency shall provide necessary Air Conditioners, lighting and fixtures including fan, RO etc, two office attendants, two data entry operators and two nos inspection vehicles including POL & drivers during the whole agreement period. AMC charges, Electricity bill, water supply bills, RO/drinking water bills etc. shall be borne by the agency. The agency shall provide the following furniture (new) for use of PIU staff at site office.

S.No.	Articles	Quantity
1.	Executive table (wooden) with side racks	4 Nos.
2.	Executive Chair	4 Nos.
3.	Office Tables	5 Nos.
4.	Office Chairs	5 Nos.
5.	Steel Almirah	8 Nos.
6.	Conference table (for 20 seats)	1 Nos.
7.	Conference chairs	30 Nos.
8.	Digital display arrangement & sound system	1set
9.	Video conference system	1Nos.

- d) The Contractor shall construct and maintain at all times during execution and till the completion of work, a temporary site office (Semi permanent structure) with adequate electric light fittings, A.C., fans, electric/ power points, switches etc. at his own cost for exclusive use of Engineer-in-Charge and his authorized representatives. Adequate toilet connected to a temporary septic tank/soakpit, drinking water purifier, cooler and air conditioners shall also be provided exclusively for the use by the Department/ Architects. The Department at its own cost may install telephone(s), fax machine(s), photocopier(s), computer(s), printer(s) etc. and the like. All the water and electricity charges (for running these fittings and equipments as per the requirement including for the equipments provided by the Department), shall be borne by the contractor. The entire site office and its surroundings shall be maintained in a neat and clean condition by the Contractor for the entire duration of the construction. The department reserves the right to keep the temporary office after the completion of the work or may allow the contractor to dismantle and take away. Then in the later case, the premises/facilities provided by the contractor shall be owned and thus demolished/ dismantled/disconnected and material carted away by him at its own cost after the completion of work or as directed by Engineer-in-Charge. The rates quoted by the Contractor shall be inclusive of providing and maintaining such facilities and nothing extra shall be payable on this account.
- e) The contractor shall make arrangement for Helmets and leather shoes (meant for construction work at sites) for all field staff of the department during the entire period of construction for safety reasons. One helmet and two pairs of shoes per staff member (maximum ten members) of the department per year shall be arranged by the contractor.
- f) The Contractor shall arrange, within fifteen days of award of work, for

1.54. SITE TEST REGISTER & MAS REGISTERS:

All test registers and MAS registers issued by the engineer-in-charge shall be maintained by the contractor which will be reviewed by the officers of PIU at regular intervals. Frequency of tests will be governed by the PIU/ Relevant Specification/Relevant Codes/ Relevant Circular/CPWDs 2009 Volume I & II with upto date correction slips.

1.55. PREVENTION AND NUISANCE AND POLLUTION CONTROL

The Contractor shall take all necessary precautions to prevent any nuisance or inconvenience to the owners, tenants or occupants of the adjacent properties and to the public in general. The Contractor shall take all care, as not to damage any other adjacent property or other services running adjacent to the plot. If any damage is done, the same shall be made good by the Contractor at his own cost and to the entire satisfaction of the Engineer-in-Charge. The Contractor shall use such methodology and equipments for execution of the work, so as to cause minimum environmental pollution of any kind during construction, to have minimum construction time and minimum inconvenience to road users and to the occupants of the buildings on the adjacent plot and public in general, etc. He shall make good at his own cost and to the entire satisfaction of the Engineer in Charge any damage to roads, paths, cross drainage works or public or private property whatsoever caused, due to the execution of the work or by traffic brought thereon, by the Contractor. Further, the Contractor shall take all precautions to prevent any pollution of streams and waterways. All waste or superfluous materials shall be carted away by the Contractor, entirely to the satisfaction of the Engineer-in-Charge.

1.56. Utmost care shall be taken to keep the noise level to the barest minimum so that no disturbance as far as possible is caused to the occupants / users of adjoining buildings. No claim whatsoever on account of site constraints mentioned above or any other site constraints not specifically stated here, shall be entertained from the Contractor. Therefore, the Contractors are advised to visit site and get first hand information of site constraints. Accordingly, they should quote their Bids. Nothing extra shall be payable on this account. Contractor shall not be given any extension of time under clause 5 of GCC amended up to date till last date or extended last date of submission of Bid on this account.

1.57. SECURITY

- i. The Agency shall be wholly responsible for security of site and works. The Agency shall be responsible for keeping unauthorized persons off the Site; and Authorized persons shall be limited to the Employees of the Agency, Sub Agency or persons authorized by the Engineer-in-Charge.
- ii. Lighting: The contractor shall provide sufficient lighting at project site, of the right type and at the right place / location for it to be properly effective. Lighting ought not to introduce the risk of electric shock. Therefore, 230V supplies should be used for those fittings, which are robustly installed, and well out of reach e.g. flood lighting or high-pressure discharge lamps. The contractor shall ensure that luminaries should always be so placed that no person is required to work in their own shadow and that the local light for one person is not a source of glare for the others. Strongly made clamps should be available for attaching luminaries to poles and other convenient supports.
- iii. Luminaries shall be robust, resistant to corrosion and rain proof especially at the point of the cable entry. The correct type of lamp for each luminary should be used and when lamps need to be replaced, it shall be in accordance with the supply voltage. Lamp holders not fitted with a lamp should be capped off. The contractor shall take every effort to illuminate the work site as per the direction of Engineer-in-charge.
- iv. In the event of any restrictions being imposed by the Security agency, PIU, Traffic or any other authority having jurisdiction in the area on the working or movement of labour / material, the contractor shall strictly follow such restrictions and nothing extra shall be payable to the contractor on such accounts. The loss of time on these accounts, if any, shall have to be made up by augmenting additional resources whatever required. Any hindrance on this account shall not be considered for giving Extension of time under clause 5 of General Condition of contract amended up to date till last date or extended last date of submission of Bid.

1.58. TRAFFIC MANAGEMENT

- i. The basic objective of the following guidelines is to lay down procedures to be adopted by contractor to ensure the safe and efficient movement of traffic and also to ensure the safety of workmen at construction sites.
- ii. All construction workers should be provided with high visibility jackets with reflective tapes as most of construction activities shall be done within right-of-way of the roads. The conspicuous of workmen at all times shall be increased so as to protect them from speeding vehicular traffic.
- iii. The Agency shall provide safety helmet, safety shoe and high visibility clothing for all employee including workmen, traffic marshal and other employees who are engaged for any work under this contract as per the following requirement:

All employees of the Agency including workmen	Traffic marshals
<p>i) Hard hat with company Logo</p> <p>ii) Safety boots</p> <p>iii) Hi-visibility waistcoat covering upper body and meeting the following requirements as per BS EN471:1994 :</p> <p>i) Background in florescent orange red in colour.</p> <p>ii) Two vertical green strips of 5cm wide on front side covering the torso at least 5cm.</p> <p>iii) Two diagonal strips of 5 cm wide on back in an 'X' pattern covering at least 5cm</p> <p>iv) Horizontal strips not less than 5cm wide running around the bottom of the vertical strip in front and 'X' pattern at back.</p> <p>v) The bottom strip shall be at a distance of 5cm from the bottom of the vest.</p> <p>vi) Strips must be retro reflective and fluorescent</p> <p>vii) Waistcoat shall have a side adjustable fit and a side and front tear away feature on vests made of nylon.</p>	<p>i) Hard hat with company Logo</p> <p>ii) Safety boots</p> <p>iii) Hi-visibility jacket upper body and meeting the following requirements as per BS EN 471:1994:</p> <p>i) Background in fluorescent orange-red in colour</p> <p>ii) Jackets with full-length sleeves with two bands of retro reflective material, which shall be placed at the same height on the garment or those of the torso. The upper band shall encircle the upper part of the sleeves between the elbow and the shoulder: the bottom of the lower band shall not be less than 5 cm from the bottom of the sleeve.</p> <p>iii) Two vertical green strips of 5cm wide on front side covering the torso at least 500 cm</p> <p>iv) Two diagonal strips of 5cm wide on front side covering the torso at least 500cm.</p> <p>v) Horizontal straight not less than 5cm wide running around the bottom of the vertical strip in front and 'X' pattern at back.</p> <p>vi) The bottom strip shall be at a distance of 5cm from the bottom of the vest.</p> <p>vii) Strips must be retro reflective and florescent</p>

- iv. Wherever operations undertaken are likely to interface with public traffic, specific traffic with the prior approval of local police authorities, and /or the concerned metropolitan/civil authorities as the case may be.
- v. Such traffic management plans shall include provision for traffic diversion and selection of alternative routes. If necessary, the agency shall carry out road widening before commencement of works to accommodate the extra load. The agency shall be responsible for getting the "Traffic Management Plan" approved from Traffic Police before taking up any construction activity on the road.
- vi. The guiding principles to be adopted for safety in construction zone are to Warn the road user clearly and sufficiently in advance, provide safe and clearly marked lanes for guiding road users and marked buffer and work zones. The agency shall provide adequate measures that control driver behavior through construction zones.
- vii. The primary traffic control devices used in work zones shall include signs, delineators, Barricades, cones, pylons, pavement markings and flashing lights, deployment of sufficient number of Marshalls on diversion roads.
- viii. Regulatory signs impose legal restriction on all traffic and they are to be used only

after consulting the local police and traffic authorities.

- a) Warning signs in the traffic control zone shall be utilized to warn the drivers of specific hazards that may be encountered.
 - b) The contractor shall place detour signage at strategic locations and install warning signs. In order to minimize disruption of access to residences and business, the contractor shall maintain at least one entrance to a property where multiple entrance exist.
 - c) A warning sign shall be installed on all secondary roads which merges with the primary road where the construction work is in progress at sufficient distance before it merges with the primary road so as to alert the road users regarding the "Construction Work in Progress".
 - d) Materials hanging over/ protruded from the chassis / body of any vehicle especially during material handling shall be indicated by red indicator (red light/flag) to indicate the caution to the road users.
- ix. The required number of traffic guards /marshals as decided by Traffic Police /Engineer-in-charge shall be provided during construction period so as to ensure safe movement of traffic without any extra cost to PIU. In case of default, the traffic guards / marshals shall be provided by PIU and cost thereof shall be recovered from the Agency in addition to recovery for violation of Bid provisions. No claim whatsoever shall be entertained on this account
- x. The site of work is to be examined as per site availability for accommodation, stores, field office, batching plant etc. and the Contractor shall make his own arrangements to provide such accommodation as per the rules of the local bodies. He shall make his own arrangements for stores, field office etc. Before Biding, he shall visit the site and assess the manner in which he is able to arrange the above facilities. The Engineer-in-Charge shall in no way be responsible for any delay on this account and no claim, whatsoever, on this account shall be entertained.

1.59. No payment shall be made for any damage caused by rain, snowfall, flood, Cyclone or any other natural calamity, whatsoever during the execution of the work. The contractor shall be fully responsible for any damage to the govt. property and the work for which payment has been advanced to him under the contract and he shall make good the same at his risk and cost. The contractor shall be fully responsible for safety and security of his material, T&P/Machinery brought to the site by him.

1.60. The contractor shall construct suitable godowns, yard at the site of work for storing all other materials so as to be safe against damage by sun, rain, damages, fire, theft etc. at his own cost and also employ necessary watch and ward establishment for the purpose at this cost.

1.61. All materials obtained from contractor shall be got checked by the representative of Engineer-in-Charge on receipt of the same at site before use.

1.62. Royalty at the prevalent rates shall be paid by the Contractor or the RMC supplier as per the terms of supply between them on all materials such as boulders, metals, sand and bajri etc. collected by him for the execution of the work, directly to the revenue authority of the state government concerned. Nothing extra shall be payable on this account.

1.63. The rates quoted by the Contractor are deemed to be inclusive of site clearance, uprooting of trees, setting out work, profile, establishment of reference bench mark(s), taking spot levels, construction of falls safety and protection devices, barriers, preparatory works, working during monsoon, working at all depths, height, lead, lift and location etc. unless clearly specified otherwise in the description of item in schedule of quantities of work and any other incidental works required to complete this work. Total stations survey instrument only shall be used for layout, fixing boundaries, and centre lines, etc. Nothing extra shall be payable on this account.

1.64. The Contractor shall keep himself fully informed of all acts and laws of the Central & State Governments, all orders, decrees of statutory bodies, tribunals having any jurisdiction or authority, which in any manner may affect those engaged or employed and anything related to carrying out the work. All the rules & regulations and bye-laws laid down by Collector/ Local Body Palitana, Coastal Zone Authorities and any other statutory bodies shall be adhered to, by the contractor, during the execution of work. The Contractor shall also adhere to all traffic restrictions notified by the local authorities. The water charges (for municipal water connection as well as tanker water) shall be borne by the contractor. Also, if

the contractor obtains water connection for the drinking purposes from the municipal authorities or any other statutory body, the consequent sewerage charges shall be borne by the contractor. The clause 31A of the General conditions of contract for PIU works is not applicable to the Bid. All statutory taxes, levies, charges (including water and sewerage charges, charges for temporary service connections and/or any other charges) payable to such authorities for carrying out the work, shall be borne by the Contractor. The Contractor shall arrange to give all notices as required by any statutory / regulatory authority and shall pay to such authority all the fees that is required to be paid for the execution of work. He shall protect and indemnify the Department and its officials & employees against any claim and/or liability arising out of violation of any such laws, ordinances, orders, decrees, by himself or by his employees or his authorized representatives. Nothing extra shall be payable on these accounts. The fee payable to statutory authorities for obtaining the various permanent service connections and Occupancy Certificate for the buildings shall be borne by the Department.

1.65. For works below ground level the contractor shall keep that area free from water. If dewatering or bailing out of water is required the contractor shall do it and payments shall be governed as provided in the item of schedule of quantities or as per stipulation in contract.

1.66. The Contractor shall make all necessary arrangements to protect the work already executed from rain and for carrying out the further work, during monsoon including providing and fixing temporary shelters, protection etc. Nothing extra shall be payable on this account. Also, no claims for hindrance shall be entertained on this account.

1.67. In case of flooding of site on account of rain or any other cause and any consequent damage, whatsoever, no claim financially or otherwise shall be entertained notwithstanding any other provisions elsewhere in the contract agreement. Also, the Contractor shall make good, at his own cost, the damages caused, if any. Also, no claims for hindrance shall be entertained on this account.

1.68. The contractor will take reasonable precautions and he/they will be responsible to prevent his workmen and employees from removing and damaging any flora (tree/plant/vegetation, wild animals, snakes/ harmful insects) from the project area.

1.69. PROTECTION OF ENVIRONMENT

i. The Agency shall take all reasonable steps to protect the environment on and off the Site and to avoid damage or nuisance to persons or to property of the public or other resulting from pollution, noise or other causes arising as a consequence of his methods of operation. The Agency shall be required to follow all the rules/norms of National Green Tribunal applicable to this work.

ii. During continuance of the contract, the Agency and his sub-agencies shall at all times, abide by all existing enactments on environmental protection and rules made there under, regulations, notifications and bye-laws of the State or Central Government, or local authorities and any other law, by-law, regulations that may be passed or notification that may be issued in this respect in future by the State or Central Government or the local authority. However, Salient features of some of the major laws that are applicable are given below:

a) Water Pollution is to be prevented as per The Water (prevention and Control of Pollution) Act, 1974 which provides for the prevention and control of water pollution and the maintaining and restoring of wholesomeness of water. 'Pollution' means such contamination of water or such alteration of the physical, chemical or biological properties of water or such discharge of any sewage or trade effluent or of any other liquid, gaseous or solid substance into water (whether directly or indirectly) as may, or is likely to, create a nuisance or render such water harmful or injurious to public health or safety, or to domestic, commercial, industrial, agricultural or other legitimate uses, or to the life and health or animals or plants or of aquatic organisms.

b) Air Pollution is to be prevented as per The Air (prevention and Control of Pollution) Act, 1981 which provides for prevention, control and abatement of air pollution. 'Air Pollution' means the presence in the atmosphere of any 'air pollutant', which means any solid, liquid or gaseous substance (including noise)

present in the atmosphere in such concentration as may be or tend to be injurious to human beings or other living creatures or plants or property or environment.

- c) Environment is to be protected as per The Environment (Protection) Act, 1986 which provides for the protection and improvement of environment and for matters connected therewith, and the prevention of hazards to human beings, other living creatures, plants and property. 'Environment' includes water, air and land and the interrelationship which exists among and between water, air and land, and human being, other living creatures, plants, micro-organism and property.
- d) The public Liability Insurance Act, 1991: This provides for public liability insurance for the purpose of providing immediate relief to the persons affected by accident occurring while handling hazardous substances and for matters connected herewith or incidental thereto. Hazardous substance means any substance or preparation which is defined as hazardous substance under the Environment (Protection) Act 1986, and exceeding such quantity as may be specified by notification by the Central Government.

1.70. ANCILLARY PROVISIONS AT SITE

- i. Traffic cones of 500mm, 750mm and 1000mm height and 300mm to 500mm in diameter or in square shape at base and are often made of plastic or rubber and normally having retro-refractories red and white band shall be used wherever required.
- ii. Drums about 800mm to 1000mm high and 300mm in diameter can be used either as channelizing or warning devices. These are highly visible, give the appearance of being formidable objects and therefore command the respect of drivers
- iii. The barricading of 3.0-meter height (or as directed by NGT from time to time) all along the periphery of the project site shall be constructed by the Agency with G.I./Galvalume profiled sheet with structural steel framework, as per design & drawings, for full length of the periphery and around construction area. The barricading shall be aesthetically maintained by regular cleaning and painting by the Agency as directed by the Engineer-in-charge, cost of which is deemed to be included in the rate quoted by the Agency. The structural dimension of the barricade, material and composition, its colour scheme, CPWD logo and other details shall be in accordance with the drawing and the direction of Engineer-in-charge, for which nothing extra will be paid to the Agency.
- iv. The barricading shall be provided continuously during the execution of the entire work till completion and shall not be removed at any stage without prior approval of the Engineer-in-Charge. All barricades shall be conspicuously visible in the dark/night time by the road users so that no vehicle hits the barricade. Conspicuous shall be ensured by affixing retro reflective stripes of required size and shape at appropriate angle at the bottom and middle portion of the barricade at suitable gap. In addition, minimum one red light or red-light blinker should be placed at the top of each barricade. The barricading shall include the following without any extra cost:
 - e)
 - f) Traffic signals during construction at site for day and night, reflective signs, direction boards, marking, glow lamps, marking, caution tape, traffic signage as per requirement, flags, Traffic Marshals etc. as directed by the Engineer-in-Charge. However, traffic police signals shall not be the responsibility of the Agency.
 - g) Cleaning of barricading every fifteen days with water and detergent so as to ensure that there is no dirt or splashes on the barricading. The dust accumulated along the barricades on the carriageway shall be removed every week.
 - h) Installation of temporary warning signs/lamps on all barricades during the hours of darkness and kept it lit there at all times during these hours.
 - i) Shifting and re-fixing in position as per the direction of Engineer-in-Charge and all incidentals to execute the job as many times as directed by Engineer-in-Charge.
 - j) Repainting of the barricading after regular interval as directed by Engineer-in-Charge and Proper maintenance of the barricading till completion of the work by repairing/replacing the damaged barricade. They shall be maintained in one

- line and level
- k) Barricading is also required to be erected by the Agency at his own cost for segregating the area of work and deep excavation from the movement of man and machinery.
- l) Fixing of Lit and Non-lit boards on the barricades of various sizes and design as per the direction of Engineer-in-charge and kept the boards lit at all times during hours of darkness.
- v. The barricade shall be allowed to erect on the boundaries marked for the work of on the drawing. However, agency may be allowed to barricade in the area which does not fall under his work's jurisdiction but required to carry out the work.
- vi. The Agency shall ensure the cleanliness of roads and footpaths by deploying proper manpower for the same. The Agency shall have to ensure proper brooming, washing of roads and footpaths, at all the time, throughout the entire stretch till the currency of the contract including disposal of sweeping without any extra cost.
- vii. Existing Services & Storage/Labour Camps within Site
 - a) Existing Services-Existing drains, pipes, cables, overhead wires, sewer lines, water lines and similar services encountered in the course of the execution of the work shall be protected/ maintained against the damage by the Agency. The Agency shall identify all underground / overhead services and take necessary measures to protect the services before starting any excavation / activity. All temporary supports and other measures required to protect and maintain the services during construction period as per direction of Engineer-in-charge, shall be deemed to be included in the quoted rate / amount of the Agency and nothing extra shall be paid on this account. For any permanent shifting, CPWD shall arrange to shift the services as and when required. However, in the interest of work, if CPWD decides to get it shifted by the Agency, then Agency shall be paid separately at the rates as decided by the Engineer-in-charge based on the actual quantum of the work involved in shifting such utilities/services. The decision of the Engineer-in-Charge in this regard shall be final and binding.
 - b) Land for Storage/Labour Camps/RMC Agency shall manage all activities within the land portion shown in the drawing. CPWD is not obliged to make any other land available for Batch Mix Plant, Store, Preserving Top Soil etc.

1.71. AGENCY'S CARE OF THE WORKS

- i. The Agency shall bear full risk in and take full responsibility for the care of the Works and Materials, goods and equipment for incorporation therein from the Commencement Date until the Completion Certificate is issued, except and to the extent that any loss of or damage to the same shall arise out of any default or neglect of the Employer.
- ii. The Agency shall throughout the execution of the Works including the carrying out of any testing, commissioning (including Integrated Testing and Commissioning), or remedying of any defect;
- iii. Take full responsibility for the adequacy, stability, safety and security of the Works, Plant, Goods, Agency's Equipment, Temporary Works, operations on Site and methods of manufacture, installation, construction and transportation;
- iv. Have full regard for the safety of all persons on or in the vicinity of the Site (including without limitation persons to whom access to the Site has been allowed by the Agency), comply with all relevant safety regulations, including provision of safety gear, and insofar as the Agency is in occupation or otherwise is using areas of the Site, keep the Site and the Works (so far as the same are not completed and occupied by the Employer) in an orderly state appropriate to the avoidance of injury to all persons and shall keep the Employer indemnified against all injuries to such persons.
- v. Provide and maintain all lights, guards, fences and warning signs and watchmen when and where necessary or required by the Engineer-in-Charge or by laws for the protection of the Works and for the safety and convenience of the public and all persons on or in the vicinity of the Site; and
- vi. Where any work would otherwise be carried out in darkness, ensure that all parts of the Site where work is being carried out are so lighted as to ensure the safety of all persons on or in the vicinity of the Site and of such work.
- vii. Agency is required to take note of all the necessary provisions in Employer's Safety, Health and Environment Manual (SHE Manual) and the Agency's price shall be inclusive of all the necessary costs to meet the prescribed safety standards. In the case,

the Agency fails in the above, the Employer may provide the necessary arrangements and recover the costs from the Agency.

1.72. HOUSE-KEEPING

- i. Housekeeping is the act of keeping the working environment cleared of all unnecessary waste, thereby providing a first-line of defence against accidents and injuries. General House-keeping shall be carried out by the Agency and ensured at all times at Work Site, Construction Depot, Fabrication Yard, Workshop, Batching Plant, Labour Camp, Stores, Offices and toilets/urinals etc. The Agency shall be responsible to provide segregated containers for disposal of debris at required places and regular cleaning of the same.
- ii. All stairways, passageways and gangways shall be maintained without any blockages or obstructions. All emergency exits passageways, exits fire doors, break-glass alarm points, fire-fighting equipment, first aid stations, and other emergency stations shall be kept clean, un-obstructed and in good working order.
- iii. All surplus earth and debris shall be removed/ disposed-off from the working areas immediately. Trucks carrying sand, earth and any pulverized materials etc. shall be covered while moving in order to avoid dust or odor impact. The tyres of the trucks leaving the site shall be cleaned with water, wherever the possibility of spillage on carriageways meant for regular road traffic exists.
- iv. No parking of trucks/trolleys, cranes and trailers etc. shall be allowed on roads, which may obstruct the traffic movement.
- v. Roads shall be kept clear and materials like: pipes, steel, sand boulders, concrete, chips and brick etc., shall not be allowed on the roads to obstruct free movement of road traffic.
- vi. Water logging or bentonite spillage on roads shall not be allowed.
- vii. Proper and safe stacking of material are of paramount importance at fabrication stores, stores and such locations where material would be unloaded for future use. The storage area shall be well laid out with easy access and material stored / stacked in an orderly and safe manner.
- viii. Flammable chemicals, compressed gas cylinders etc. shall be safely stored. Unused/surplus cables, steel items and steel scrap lying scattered at different places within the working areas shall be removed to marked locations(s). All wooden scrap, empty wooden cable drums and other combustible packing materials, shall be removed from the site. Lumber with protruding nails shall be either bent/ removed and properly stacked.
- ix. The compliance of above provisions are deemed to be included in the quoted amount of the Agency and no claim / payment whatsoever shall be entertained on this account.

1.73. SAFETY

- i. Minimum one Safety Officer/ Manager is required to be at site at all times.
- ii. Qualifications of Safety Coordinator/ Manager should not be less than those prescribed in local regulation in building and other construction workers (regulation of employment & conditions of service) central Rules,1998.
- iii. Agency shall arrange for initial Site orientation / induction of all Workmen / Supervising personnel on 'Safety practices' before beginning of work at site. This shall include a briefing about project, safety policy, site safety rules and site facilities.
- iv. Agency shall conduct a daily toolbox talk for all workers previous to starting to work. These tool box talks should include topics related to ongoing work activities and precautions to be taken on daily activities.
- v. Agency shall ensure participation of his site in-charge and the safety coordinator in the safety meetings arranged at intervals decided by the Engineer-in-Charge.
- vi. Agency shall also submit a Health & Safety report on monthly basis or as directed to Engineer-in-Charge.

1.74. AGENCY'S SAFETY ENGINEER / SAFETY OFFICERS SHALL:

- i. Assist the Agency's Construction Manager and coordinate with consultant's Safety Supervisor for the implementation of the HSE program within corresponding work groups.
- ii. Get familiarized with all government, and Owner's safety and health regulations, including reports and work permits procedures.
- iii. Inspect the construction area on a regular basis in order to verify appropriate corrective actions and prepare reports to their Construction Manager.

- iv. Review the SAP (Safety Action Plan) prepared by line supervisor.
- v. Co-ordinate with supervisors and foremen periodical safety meetings and lead daily safety meetings.
- vi. Conduct safety training classes for all workers.
- vii. Participate in Tool Box Talks.
- viii. Suggest safety promotional activities.

1.75. INFORMATION TO BE PROVIDED BY AGENCY

- i. Health, Safety and Environment policy
- ii. A detailed Health, Safety and Environment plan.
- iii. Names of the Safety personnel.
- iv. Employers' liability insurance policy.
- v. Work method statements for critical operations such as lifting etc.
- vi. Test Certificates for lifting gear, lifting equipment and accessories.
- vii. Information related to hazardous materials used and corresponding MSDS (Materials Safety Data Sheets).
- viii. Daily labour returns
- ix. Copies of all Statutory Records.
- x. Copies of the Agency Safety's reports
- xi. Supervisor's reports of his findings on site inspections.

1.76. INITIAL SITE ORIENTATION / INDUCTION

- i. The number of orientation sessions presented each week will vary to the greatest extent possible in order to accommodate the Agency's needs to bring labour on site.
- ii. The following topics shall be included during such presentations, which will change during the course of the project to meet changing site requirements:
 - c) Introduction to the site and project, with a brief overview of the project under constructions.
 - d) Owner and consultant's HSE policy and safety philosophy.
 - e) Personal Protective Equipment (hard hats, safety glasses, safety steeltoed boots)
 - f) Housekeeping
 - g) Working in and around excavations
 - h) Working at height (ladders, scaffolds, free edges and openings)
 - i) The Safety Action Plan (SPA)
 - j) First aid facilities, Accident reporting system
 - k) Emergency procedure
 - l) Smoking restrictions, prohibition of alcohol and drugs.
 - m) The Agency will conduct a site visit for his new employees in groups of less than 25 so that they get acquainted with essential services, their work place, and general site layout.
 - n) Gate pass will be issued only after completion of the site orientation /induction.

1.77. PERSONAL PROTECTIVE EQUIPMENTS (PPEs)

- i. The Agency shall provide required PPEs to workmen to protect against safety and/or health hazards. Primarily PPEs are required for the following protection.
 - a) Head Protection (Safety helmets)
 - b) Foot Protection (Safety footwear, Gumboot, etc.)
 - c) Body Protection (High visibility clothing (waistcoat/jacket, Apron, etc.)
 - d) Personal fall protection (Full body harness, Rope-grap fall arrester, etc.)
 - e) Eye protection (Goggles, Welders glasses, etc)
 - f) Hand protection (Gloves, finger coats, etc.)
 - g) Respiratory Protection (Nose mask, SCBAs, etc.)
 - h) Hearing protection (Ear plugs, Ear muffs, etc)
- ii. The PPEs and safety appliances provided by the Agency shall be of the standard as prescribed by Bureau of Indian Standards (BIS). If materials conforming to BIS standards are not available, the Agency shall procure PPE and safety appliances, as approved by the Engineer-in-charge. Safety Helmet Colour

Code	Person to use
White	PIU/PIU staff
Grey	All designers, Architect, Consultants etc.

Violet	Main Agencies (Engineers/Supervisors)
Blue	All Sub-Agencies (Engineers/Supervisors)
Red	Electricians (both Agency and sub-Agency)
Green	Safety Professionals (Both Agency and sub Agencies)
Orange	Security Guards/Traffic Marshals
Yellow	All workmen
White (with "Visitor" sticker)	Visitors

*(Every Helmet should have the LOGO affixed/painted).

- iii. All construction workers should be provided with high visibility jackets with reflective tapes confirming to the requirement specified under BS EN 471: 1994. The conspicuous of workmen at all times shall be increased so as to protect them from speeding vehicular traffic.
- iv. In addition to the above, any other PPE required for any specific jobs like, welding and cutting, working at height, tunnelling etc. shall also be provided to all workmen and also ensure that all workmen use the PPEs properly while on the job. The Agency shall not pay any cash amount in lieu to PPE to the workers/sub- Agencies and expect them to buy and use during work.
- v. The Agency shall at all-time maintain a minimum of 10% spare PPEs and safety appliances and properly record and show to the Engineer-in-charge during the inspections. It is always the duty of the Agency to provide required PPEs for all visitors & CPWD staff. Towards this required quantity of PPEs shall be kept always at the security post.
- vi. Notwithstanding the above, the Agency shall at their expense arrange for the safety provision as per all relevant Indian Standard Safety Codes & local byelaws. The Agency shall provide all facilities in connection therewith and shall also issue the identity card to his labourer.

1.78. SANITATION AND HYGIENE MEASURES

In order to provide adequate sanitary conditions for all personnel at site, the following provisions as a part of the temporary facilities to be provided by the Agency:

- i. Provision for an adequate supply of potable water
- ii. Provision for toilets and hand wash basins
- iii. Garbage disposal and regular collection
- iv. Proper drainage and sewer disposal
- v. Other special hygienic operations viz. Fumigation, pest controls etc.
- vi. Worker's Rest Space:
- vii. Smoking hut
- viii. Sunshade and/or site canteen
- ix. Smoking on site is not allowed, " No smoking " signs shall be displayed at prominent location including stores/ storage places.

1.79. WORK AT HEIGHTS

- i. During construction of buildings/towers safety net (horizontal and vertical) shall be used by Agency to check/control falling of any object. The Agency/vendor shall also take the other safety measures used during construction, for e.g. Personal Protective Equipments (PPEs), safety during working at heights etc.
- ii. The Agency shall provide proper scaffolding and working platforms with handrails to work at higher elevations and Tools and loose material should not be left on the scaffolding from where they are likely to fall. Persons should use safety belts while working near open edge where it is not possible to provide hand rails.
- iii. Things should not be thrown from heights and should be brought down or taken up with the help of ropes. While work is being carried on at higher elevations, warning notices should be posted below or barricade the area so as to draw the attention of persons and prevent them from coming under the falling objects.
- iv. Defective scaffoldings, damaged ladders, insufficient working platforms etc. Shall not be permitted. Wherever necessary, light weight mobile tower scaffolds or hydraulic platforms should be used.
- v. Proper access should be available to the work spot. Nobody should jump over open area between equipment, pipes and rails etc. from where they may slip. Walking over beams, narrow pipes etc. should be prohibited.
- vi. The area from where the materials are pulled up with ropes etc. should have hand railings and the person should keep firm footing. They should not lean over the

- handrails and should use safety belts to protect themselves from fall due to body imbalance.
- vii. The Agency should reduce the hazards associated with falls first through engineering controls and Have a formal fall protection program in accordance with Factories Act requirements. Agency should Institute personal fall arrest systems, administrative controls and training when engineering controls are not feasible.
- viii. The Agency shall have the necessary fall protection equipment to safely perform the job and properly train workers in the use of fall protection equipment and supervisors (or competent personnel) shall ensure the use of fall protection equipment as required. Agency shall obtain work permit from the Consultant prior to starting of activities requiring fall protection.
- ix. Should Use powered access safely and Protect holes and leading edges, e.g. with hand rails and toe boards
- x. The construction waste from the height should be transferred through closed chutes.
- xi. All other measures to be taken for the safety at project shall be ensured by the Agency.
- xii. It shall be deemed that rates quoted by the Agency are inclusive of all the expenditures incurred in the safety procedures. No extra payment on this account shall be payable to Agency.

1.80. UNFORESEEABLE DIFFICULTIES

Except as otherwise specifically stated elsewhere in the Contract:

- i. The Agency shall be deemed to have obtained all necessary information as to risks, contingencies and other circumstances which may influence or affect the Works;
- ii. By signing the Contract, the Agency accepts total responsibility for having foreseen all difficulties and costs of successfully completing the Works; and
- iii. The Contract Price shall not be adjusted to take account of any unforeseen difficulties or costs.
- iv. CPWD shall not provide any material either on chargeable or on free issue basis to the gency for execution of the project.

1.81. SETTINGOUT

- i. The Contractor shall establish, maintain and assume responsibility for grades, lines, levels and benchmarks. He shall report any errors or inconsistencies regarding grades, lines, levels, dimensions etc. to the Engineer -in-Charge before commencing work. Commencement of work shall be regarded as the Contractor's acceptance of such grades, lines, levels, and dimensions and no claim shall be entertained at a later date for any errors found.
- ii. If at any time, any error appears due to grades, lines, levels and benchmarks during the progress of the work, the Contractor shall, at his own expense rectify such error, if so required, to the satisfaction of the Engineer -in-Charge. Nothing extra shall be payable on this account.

1.82. Therateofitemsofflooringisinclusiveofprovidingsunkenflooringin bathrooms,kitchenetc.andnothingextraonthisaccountisadmissible.

1.83. A sitelaboratorywith the allequipments as specified in PIU/ Relevant Specification/Relevant Codes/ Relevant Circular/CPWDs/in thisagreement shallbe established,madefunctionaland maintainedwithinonemonthfrom theawardofworkasperAnnexure-I withoutanyextracosttothedepartment.Incaseofnoncompliance/delay incomplianceinthis,arecovery@Rs.10,000/- perdaywillbeimposedwhich willbe recoveredfrom the immediate nextR/ABillof the Contractor.

1.84. INTEGRATEDSERVICE DRAWINGS

Beforetakingupthework,thecontractor shallbeprovidedwith integrated drawingsfor variouscivilandelectricalservicesshowingdetailsof lay out plan includingsectionalelevationsandcontractor shallplanandmobilize his resourcesas perthe Integrateddrawingsandas perthe site conditionsto facilitateconvenient execution,installationaswellasmaintenanceofthese services. Nothingextra shallbe payable onthisaccount.

1.85. The Contractor shall do proper sequencing of the various activities by suitably staggering the activities within various pockets in the plot so as to achieve early completion. The agency has to deploy adequate equipment, machinery and labour as required for the completion of the entire work within the stipulated periods specified. Also ancillary facilities shall be provided by contractor commensurate with requirement to complete the entire work within the stipulated period. Nothing extra shall be payable on this account. Adequate number/sets of equipment in working condition, along with adequate stand-by arrangements, shall be deployed during entire construction period. It shall be ensured by the Contractor that all the equipment, Tools & Plants, machinery etc. provided by him are maintained in proper working conditions at all times during the progress of the work and till the completion of the work. Further, all the constructional tools, plants, equipment and machinery provided by the Contractor, on site of work or his workshop for this work, shall be exclusively intended for use in the construction of this work and they shall not be shifted/removed from site without the permission of the Engineer-in-Charge.

1.86. The Contractor shall maintain all the work in good condition till the completion of entire work. The Contractor shall be responsible for and shall make good, all damages and repairs, rendered necessary due to fire, rain, traffic, floods or any other causes. The Engineer-in-Charge shall not be responsible for any claims for injuries to person/workmen or for structural damage to property happening from any neglect, default, want of proper care or misconduct on the part of the Contractor or of any other of his representatives, in his employment during the execution of the work. The compensation, if any, shall be paid directly to the Department/authority / persons concerned, by the Contractor at his own cost.

1.87. The agency shall be responsible for handing over of the completed buildings along with all necessary Civil, E&M services & Horticultural works complete in all respect with full satisfaction of IISER .

1.88. ROYALTY

Royalty at the prevalent rates shall be paid by the Contractor or the RMC supplier as per the terms of supply between them, on all materials such as boulders, metals, all sizes stone aggregates, brick aggregates, coarse and fine sand, moorum, river sand, gravels and bajri etc. collected by him for the execution of the work, directly to the revenue authority of the state government concerned. Further, contractor needs to submit proof of submission of full royalty to the state government or local authority. Nothing extra shall be payable on this account.

1.89. PRESERVATION AND CONSERVATION MEASURES

- i. Existing drains, pipes, cables, over-head wires, sewer lines, water lines and similar services, if any, encountered in the course of the execution of work shall be protected against the damage by the contractor at his own expense. In case the same are to be removed and diverted, expenditure incurred in doing so shall be payable to the contractor. The contractor shall work out the cost, get the same approved by Engineer-in-Charge before taking up actual execution. The contractor shall not store materials or otherwise occupy any part of the site in a manner likely to hinder the operation of such services.
- ii. All fossils, coins, articles of value of antiquity, structures and other remains or things of geological or archaeological interest discovered on project location during excavation/construction shall be the property of the Government, and shall be dealt with as per provisions of the relevant legislation. The contractor will take reasonable precaution to prevent his work men or any other persons from removing and damaging any such article or thing. He will, immediately upon discovery thereof and before removal acquaint the Engineer-in-charge of such discovery and carry out the official instructions of Engineer-in-charge for dealing with the same, till then all work shall be carried out in a way so as not to disturb/damage such article or thing.

1.90. RESPONSIBILITY

- i. Heshall protect and indemnify the IISER Palitana Department (CPWD) and its officials & employees against any claim and /or liability arising out of violations of any such laws, ordinances, orders, decrees, by himself or by his employees or his authorized representatives. Nothing extra shall be payable on these accounts.
- ii. The fee payable to statutory authorities for obtaining the various permanent service connections and Building Use Certificate for the building shall be borne by the CPWD.
- iii. The Contractor shall assume all liability, financial or otherwise in connection with this contract and shall protect and indemnify the Department from any and all damages and claims that may arise on any account. The Contractor shall indemnify the Department against all claims in respect of patent rights, royalties, design, trademarks- of name or other protected rights, damages to adjacent buildings, roads or members of public, in course of execution of work or any other reasons whatsoever, and shall himself defend all actions arising from such claims and shall indemnify the Department in all respect from such actions, costs and expenses. Nothing extra shall be payable on this account.

1.91. CO-OPERATION WITH OTHER CONTRACTORS/SPECIALIZED AGENCIES/SUB-CONTRACTORS

- i. The Contractor shall take all precautions to abide by the environmental related restrictions imposed by any statutory body having jurisdiction in Palitana as well as prevent any pollution of streams, ravines, river bed and waterways. All waste or superfluous materials shall be transported by the Contractor, entirely to the satisfaction of the Engineer- in-Charge and disposed at designated places only. Utmost care shall be taken to keep the noise level to the barest minimum so that no disturbance as far as possible is caused to the occupants / users of adjoining buildings. No claim what so ever on account of site constraints mentioned above or any other site constraints, lack of public transport, , inadequate availability of skilled, semi-skilled or unskilled workers in the near vicinity, non-availability of construction machinery spare parts and any other constraints not specifically stated here, shall be entertained from the Contractor. Therefore, the Bidders are advised to visit site and get first-hand information of site constraints. Accordingly, they should quote their Bids. Nothing extra shall be payable on this account.
- ii. The Contractor shall cooperate with and provide the facilities to the sub-Contractors and other agencies working at site for smooth execution of the work. The contractor shall indemnify the Department (CPWD) against any claim(s) arising out of such disputes. The Contractor shall:
 - a) Allow use of scaffolding, toilets, sheds etc.
 - b) Properly co-ordinate their work with the work of other Contractors.
 - c) Provide control lines and benchmarks to his Sub-Contractors and the other Contractors.
 - d) Provide electricity and water at mutually agreed rates.
 - e) Provide hoist and crane facilities for lifting material at mutually agreed rates.
 - f) Co-ordinate with other Contractors for leaving inserts, making chases, alignment of services etc. at site.
 - g) Adjust work schedule and site activities in consultation with the Engineer-in- Charge and other Contractors to suit the overall schedule completion.
 - h) Resolve the disputes with other Contractors/ sub-contractors amicably and the Engineer-in-Charge shall not be made intermediary or arbitrator.
- iii. The work should be planned in a systematic manner so as to ensure proper co-ordination of various disciplines viz. sanitary & water supply, drainage, rain water harvesting, electrical, fire fighting, information technology, communication & electronics and any other services.
- iv. Other agencies will also simultaneously execute and install the works of sub-station / generating sets, air-conditioning, lifts, etc. for the work and the contractor shall afford necessary facilities for the same. The contractor shall leave such recesses, holes, openings trenches etc. as may be required for such related works (for which inserts, sleeves, brackets, electrical conduits, base plates, clamps etc. shall be supplied free of cost by the department unless otherwise specifically mentioned) and the contractor shall fix the same at time of casting of concrete, stone work and brick work, if required, and nothing extra shall be payable on this account.
- v. The contractor shall conduct his work, so as not to interfere with or hinder the

progress or completion of the work being performed by other contractor(s) or by the Engineer-In-Charge and shall as far as possible arrange his work and shall place and dispose off the materials being used or removed so as not to interfere with the operations of other contractor or he shall arrange his work with that of the others in an acceptable and in a proper co-ordination manner and shall perform it in proper sequence to the complete satisfaction of others.

1.92. SUPERVISION OF WORK

The Contractor shall depute Site Engineer & skilled workers as required for the work. He shall submit organization chart along with details of Engineers and supervisory staff. It shall be ensured that all decision making powers shall be available to the representatives of the Contractor at New Palitana itself to avoid any likely delays on this account. The Contractor shall also furnish list of persons for specialized works to be executed for various items of work. The Contractor shall identify and deploy key persons having qualifications and experience in the similar and other major works, as per the field of their expertise. If during the course of execution of work, the Engineer-in-Charge is of the opinion that the deployed staff is not sufficient or not well experienced; the Contractor shall deploy more staff or better-experienced staff at site to complete the work with quality and in stipulated time limit. Principle Technical representative/ Project Manager of the Contractor having minimum twenty years of experience in similar nature of work as mentioned in the clause 36 of the General Conditions of the Contract, shall always be available at the site during the actual execution of the work.

1.93. SPECIALIZED AGENCIES

- i. The composite Bid comprises of two main components: viz. civil work and E & M works.

The list of specialized agencies for civil works is as below:

- a) Water proofing treatment.
- b) Stone cladding.
- c) Granite & Marble flooring.
- d) Aluminum doors and windows, aluminum partition.
- e) Silicon paint and Texture finish & Art work.
- f) Gypsum plaster work.
- g) Under deck insulation.
- h) SS space frame
- i) Aluminum Form work system, (for R.C.C monolithic construction)
- j) Fire Check Door
- k) False Ceiling

- ii. The main contractor shall submit the credential of specialized agency well in advance as per the direction of Engineer-in-charge. After verification of the same, written approval will be conveyed to main contractor in this regard. The quantum of credentials will be broadly in line with PIU guidelines. The main contractor shall not change the specialized agency. However, if the change is warranted, he may do so, with permission of Engineer-in-charge. However before making any such change he has to enter into similar agreement as with previous agency & submit the same to Engineer-in-charge for approval. This shall however be without any change in the accepted rates of the contract agreement and without any cost implication to the Department.

- iii. The main contractor cannot work as a specialized Agency unless his name is approved as specialized agency by Engineer-in-charge in accordance with Sr. No.(i) above.

- iv. It shall be the responsibility of main contractor to sort out any dispute / litigation with the Specialized Agencies without any time & cost overrun to the Department. The main contractor shall be solely responsible for settling any dispute / litigation arising out of his agreement with the Specialized Agencies. The contractor shall ensure that the work shall not suffer on account of litigation/ dispute between him and the specialized agencies / sub-contractor(s). No claim of hindrance in the work shall be entertained from the Contractor on this account. No extension of time shall be granted and no claim what so ever, of any kind, shall be entertained from the Contractor on account of delay attributable to the selection/rejection of the Specialized Agencies or any dispute amongst them.

1.94. RATES

- i. The rates quoted by the Contractor are deemed to be inclusive of site clearance, uprooting of tree roots if any setting out work, profile, setting lay out on ground, establishment of reference bench mark(s), installing various signage, taking spot levels, survey with total station, construction of all safety and protection devices, compulsory use of helmet and safety shoes, and other appropriate safety gadgets by workers, imparting continuous training for all the workers, barriers, preparatory works, construction of clean, hygienic and well ventilated workers housings in sufficient numbers as per drawing supplied by Engineer in charge, working during monsoon or odd season, working beyond normal hours, working at all depths, height, lead, lift, levels and location, implementation of green building norms to achieve desired GRIHA Rating etc. and any other unforeseen but essential incidental works required to complete this work. Nothing extra shall be payable on this account and no extension of time for completion of work shall be granted on these accounts.
- ii. The rates quoted by the Bider, shall be firm and inclusive of all taxes and levies (including works contract tax but including service tax).
- iii. No foreign exchange shall be made available by the Department for importing (purchase) of equipment, plants, machinery, materials of any kind or any other items required to be carried out during execution of the work. No delay and no claim of any kind shall be entertained from the Contractor, on account of variation in the foreign exchange rate.
- iv. Ancillary and incidental facilities required for execution of work like labour accommodations, stores, fabrication yard, offices for Contractor, watch and ward, temporary ramp required to be made for working at the basement level, temporary structure for plants and machineries, water storage tanks, installation and consumption charges of temporary electricity, telephone, water etc. required for execution of the work, liaison and pursuing for obtaining various No Objection Certificates, completion
- v. certificates from local bodies etc., protection works, testing facilities / laboratory at site of work, facilities for all field tests and for taking samples etc. during execution or any other activity which is necessary (for execution of work and as directed by Engineer-in- Charge), shall be deemed to be included in rates quoted by the Contractor, for various items in the schedule of quantities. Nothing extra shall be payable on these accounts. Before start of the work, the Contractor shall submit to the Engineer-in-Charge, a site / construction yard layout, specifying areas for construction, FC, positioning of machinery, material yard, cement and other storage, steel fabrication yard, site laboratory, water tank, etc.
- vi. For completing the work in time, the Contractor might be required to work in two or more shifts (including night shifts). No claim whatsoever shall be entertained on this account, notwithstanding the fact that the Contractor may have to pay extra amounts for any reason, to the labourers and other staff engaged directly or indirectly on the work according to the provisions of the labour and other statutory bodies regulations and the agreement entered upon by the Contractor with them.
- vii. All material shall only be brought at site as per program finalized with the Engineer-in- Charge. Any pre-delivery of the material not required for immediate consumption shall not be accepted and thus not paid for.

1.95. SAFETY PRACTICES SIGN BOARDS

- i. Warning / Caution Boards: All temporary warning / caution boards / glow signage display such as "Construction Work in Progress", "Keep Away", "No Parking", Diversions & protective Barricades etc. shall be provided and displayed by the Contractor, wherever required. These glow signage and red lights shall be suitably illuminated during night also. The Contractor shall be solely responsible for damage and accident caused, if any, due to negligence on his part. Also he shall ensure that no hindrance, as far as possible, is caused to general traffic during execution of the work. This signage shall be dismantled & taken away by the Contractor after the completion of work, only after approval of the Engineer - in - Charge. Nothing extra shall be payable on this account. If the contractor fails to provide the warning /caution boards within 7 days of written direction of Engineer In charge or his authorised representative, recovery of Rs. 10,000/- on per day basis shall be made.

- ii. Sign Boards: The Contractor shall provide and erect a display board of size and shape as required and paint over it, in a legible and workman like manner, the details about the salient features of the project, as required by the Engineer-in-Charge. The Contractor shall fabricate and put up a sign board in an approved location and to an approved design indicating name of the project, Client/Owner, Engineer-in-charges, Structural Consultants, Department etc. besides providing space for names of other Contractors, Sub-Contractors and specialized agencies within 15 days from issue of award letter. Nothing extra shall be payable on this account. In case of non compliance/delay in compliance in this, a penalty @ Rs. 5,000/- per day will be imposed which will be recovered from the immediate next R/A Bill of the Contractor.
- iii. Necessary protective and safety equipments shall be provided to the Site Engineer, Supervisory staff, labour and technical staff of the contractor by the Contractor at his own cost and to be used at site.
- iv. All signage shall be dismantled and taken away by the contractor after completion of the work with the approval of Engineer in charge. No payment shall be made on this account.
- v. No inflammable materials including P.O.L shall be allowed to be stored in huge quantity at site. Only limited quantity of P.O.L may be allowed to be stored at site subject to the compliance of all rules / instructions issued by the relevant authorities and as per the direction of Engineer - in- Charge in this regard. Also all precautions and safety measures shall be taken by the Contractor for safe handling of the P.O.L products stored at site. All consequences on account of unsafe handling of P.O.L shall be borne by the Contractor.

1.96. QUALITY ASSURANCE

- i. The proposed buildings are prestigious project and quality of work is of paramount importance. Contractor shall have to engage well- experienced skilled labour and deploy modern T&P and other equipment to execute the work. Many items like exposed finish form work, specialized flooring work, Polysulphide sealant and backer rod fixing in expansion joints, factory made door- window shutters, proper slope maintaining in toilet units, sanitary- water supply installation, textured finishing, grit plastering with aluminium channel insertions, water proofing treatment will specially require engagement of skilled workers having experience particularly in execution of such items.
- ii. The contractor shall ensure quality construction in a planned and time bound manner. Any sub-standard material / work beyond set out tolerance limit shall be summarily rejected by the Engineer-in-charge & contractor shall be bound to replace / remove such sub-standard / defective work immediately. If any material, even though approved by Engineer-In-Charge is found defective or not conforming to specifications shall be replaced / removed by the contractor at his own risk & cost.
- iii. The contractor/ associated agency shall extend full cooperation to Third Party Quality Assurance Agencies engaged by the department for the Project during their field visits for arranging the necessary quality assurance tests for materials and the construction works.
- iv. In addition to the supervision of work by PIU engineers, the Consultants deployed by PIU shall also be carrying out regular and periodic inspection of the ongoing activities in the work and deficiencies, shortcomings, inferior workmanship pointed out by them shall be communicated by PIU engineers to the contractor. Upon receipt of instructions from Engineer in Charge these are also to be made good by necessary improvement, rectification, replacement up to his complete satisfaction. Special attention shall be paid towards line and level of internal and external plastering, exposed smooth surface of RCC members by providing fresh shuttering plates, rubberized linings to all the shuttering joints, accurate joinery work in wooden doors and windows, thinnest joints in stone/ tiling / cladding work, non-hollowness in floor and dado tiles work, protection of scratches over flooring by impounding layer of plaster of Paris, water tight pipe linings, absence of hollow vertical joints in brick masonry, proper compaction of filled up earth etc. to achieve an Institution of International standards and up keeping of quality assurance shall be of paramount importance, as such.
- v. The Contractor shall submit, immediately after the award of work within 15 days, a detailed and complete method statement for the execution, testing and Quality Assurance Plan/procedures for basic materials and such items, to be followed during

the execution of the work, for approval of the Engineer-in-Charge. All the materials to be used in the work, to give the finished work complete in all respects, shall comply with the requirements of the specifications and shall pass all the tests required as per specifications as applicable or such specifications / standards as directed by the Engineer-in-Charge. Further, a recovery of Rs. 30,000/- shall be made on per day basis in case of delay in submission of the above programme.

- vi. All materials and fittings brought by the contractor to the site for use shall conform to the samples approved by the Engineer-in-charge which shall be preserved till the completion of the work. If a particular brand of material is specified in the item of work in Schedule of Quantity, the same shall be used after getting the same approved from Engineer-In- Charge. Wherever brand / quality of material are not specified in the item of work, the contractor shall submit the samples as per suggested list of brand names given in the Bid document / particular specifications for approval of Engineer-In-Charge. For all other items, materials and fittings of ISI Marked shall be used with the approval of Engineer-In-Charge. Wherever ISI Marked material / fittings are not available, the contractor shall submit samples of materials / fittings manufactured by firms of repute conforming to relevant specifications or IS codes and use the same only after getting the approval of Engineer-In-Charge.
- vii. The Contractor shall procure and provide all the materials from the manufacturers / suppliers as per the list attached with the Bid documents, as per the item description and particular specifications for the work. The equivalent brand for any item shall be permitted to be used in the work, only when the specified make is not available. This is, however, subject to documentary evidence produced by the contractor for non-availability of the brand specified and also subject to independent verification by the Engineer-in-Charge. In exceptional cases, where such approval is required, the decision of Engineer-in-Charge as regards equivalent make of the material shall be final and binding on the Contractor. No claim, whatsoever, of any kind shall be entertained from the Contractor on this account. Nothing extra shall be payable on this account. Also, the material shall be procured only after written approval of the Engineer-in-Charge.

1.97. Agency shall submit minimum "Quality Assurance" plan within 15 days after award of work which shall be consisting of:

- i. Lot size, number of required tests and frequency of testing. While deciding these criteria PIU/ Relevant Specification/Relevant Codes/ Relevant Circular/CPWDs & Provisions of BIS Code and Standard Practices may be referred. Volume of work, Practical Difficulties and Site Conditions etc. may also be kept in view. The lot size, number of tests and frequencies of testing can be altered or modified by the Engineer-in-charge from the prescribed limits
- ii. It should clearly indicate the Machinery and other Tool & Plants required to be deployed at site by the agency. Entire Machinery and T&P may not be required at the start of work, therefore, a proper time schedule by which each Machinery & T&P is to be brought at site should also be indicated.
- iii. Receipt of Material, testing of the same & Maintenance of Register of Tests.
- iv. All the registers of tests carried out at Construction Site or in outside laboratories shall be maintained by the agency. Which may be inspected by Engineer-in-charge or his/her designee at any point of time.
- v. The Agency shall allow access to Third Party Quality Assurance Agency e(TPQAA) engaged by Engineer-in-charge to have a control on quality and methodology of execution. At least 25% of Samples of materials including Cement Concrete Cubes shall be taken jointly by Agency and TPQAA /Engineer-in-charge or his authorised representative. All arrangements for transporting and getting them tested shall be made by the Agency.
- vi. All the test in field lab setup at Construction Site shall be carried out by the Quality control team to be engaged by the Agency which can be witnessed by Engineer-in-charge or his/her designee. A daily report of Tests to be conducted on a day shall be submitted to Engineer-in-charge or his/her designee.
- vii. All the entries in the registers will be made by the designated Engineering Staff of the Agency.
- viii. Agency shall be responsible for safe custody of all the test registers.
- ix. Submission of copy of all test registers, Material at Site Register and hindrance register along with each alternate Running Account Bill and Final Bill shall be

- mandatory.
- x. All material received at site shall be entered in MAS Register and copy of Supply order, MTC & Bill-invoice shall be maintained in order. The MAS Registers including Cement and Steel Registers shall be maintained by a qualified staff of Agency which may be inspected by Engineer-in-charge or his/her designee at any time. The daily report of receipt of material shall be sent to Engineer-in-charge or his/her designee.
- xi. All materials whether obtained from Govt. stores or otherwise shall be got checked by the Engineer-in-Charge or his authorized supervisory staff on receipt of the same at site before use.
- xii. The tests, as necessary, shall be conducted in the laboratory approved by the Engineer-in-Charge. The samples shall be taken for carrying out all or any of the tests stipulated in the particular specifications and as directed by the Engineer-in-Charge or his authorized representative.
- xiii. All the registers of tests carried out at Construction Site or in outside laboratories and all material at site (MAS) registers including cement register shall be maintained by the contractor which shall be issued to the contractor by Engineer-in-charge. All the entries in the registers will be made by the designated Engineering Staff of the contractor and same should be regularly reviewed by JE/AE/AEE/EE. Contractor shall be responsible for safe custody of all the registers
- xiv. The Contractor shall at his own risk and cost make all arrangements and shall provide all such facilities including material and labour, the Engineer-in-Charge may require for collecting, preparing, forwarding the required number of samples for testing as per the frequency of test stipulated in the contract specifications or as considered necessary by the Engineer-in-Charge, at such time and to such places, as directed by the Engineer-in-Charge. Nothing extra shall be payable for the above.
- xv. The Contractor or his authorized representative shall associate in collection, preparation, forwarding and testing of such samples. In case he or his authorized representative is not present or does not associate him, the result of such tests and consequences thereon shall be binding on the Contractor. The Contractor or his authorized representative shall remain in contact with the Engineer-in-Charge or his authorized representative associated for all such operations. No claim of payment or claim of any other kind, whatsoever, shall be entertained from the Contractor.
- xvi. All the testing charges shall be borne by the contractor/ department in the manner indicated below
- a) By the contractor, if the results show that the material does not conform to relevant specifications and BIS codes or any other relevant code for which confirmatory test is carried out.
- b) By the department, if the results show that the material conforms to relevant specifications and BIS codes or any other relevant code for which confirmatory test is carried out.
- xvii. All the hidden items such as water supply lines, drainage pipes, electrical conduits, sewers etc. are to be properly tested & got approved as per the design conditions before covering.
- xviii. Water tanks, taps, sanitary, water supply and drainage pipes, fittings and accessories should conform to byelaws and municipal body / corporation where PIU/ Relevant Specification/Relevant Codes/ Relevant Circular/CPWDs are not available. The contractor should engage licensed plumbers for the work and get the materials (fixtures/fittings) tested by the Municipal Body/Corporation authorities wherever required at his own cost. Nothing extra shall be paid on this account.
- xix. The contractor shall give performance test of the entire installation(s) as per the standing specifications before the work is finally accepted and nothing extra whatsoever shall be payable to the contractor for the test.
- xx. The Contractor shall arrange electricity at his own cost for testing of the various electrical installations as directed by Engineer-in-Charge and for the consumption by the contractor for executing the work. Also all the water required for testing various electrical installations, fire pumps, wet riser / fire fighting equipments, fire sprinklers etc. and also testing water supply, sanitary and drainage lines, water proofing of underground sump, overhead tanks, water proofing treatment etc. shall be arranged by the contractor at his own cost. Nothing extra shall be payable on this account.
- xxi. The Contractor shall make available, on request from the Department, the copies of challan, cash memos, receipts and other certificates, if any, vouchers towards the quantity and quality of various materials procured for the work. The Contractor shall

also provide information and necessary documentation on the name of the manufacturer, manufacturer's product identification, manufacturer's instructions, warning, date of manufacturing and test certificates (from manufacturers for the product for each consignment delivered at site), self life, if any etc., for the department to ensure that the material have been procured from the approved source and is of the approved quality, as directed by the Engineer-in-Charge. Wherever specified, day-to-day account of receipt of such material shall be maintained at site of work.

- xxii. If the Contractor does not provide adequate supporting staff or labour or both for carrying out field tests or collecting and forwarding samples to outside laboratory or for maintaining test records, Engineer in charge may carry out field tests or collect and forward sample to outside laboratory or appoint any person to maintain the registers at risk and cost of Contractor. The charges so incurred shall be entirely borne by contractor and shall be deducted from Running or final bill of contractor. Further, recovery of Rs. 10,000/- for each default shall be levied to contractor.
- xxiii. In case there is any discrepancy in frequency of testing as given in list of mandatory tests and that in individual sub-heads of work as per PIU/ Relevant Specification/Relevant Codes/ Relevant Circular/CPWDs, higher of the two frequencies of testing shall be followed and nothing extra shall be payable on this account.
- xxiv. A site laboratory with the minimum equipment as specified in Schedule F of bid document and as given in PIU/ Relevant Specification/Relevant Codes/ Relevant Circular/CPWDs vol.I 2009 shall be established by the contractor, made functional and maintained within one month from the award of work without any extra cost to the department. All the relevant and applicable standards and specifications shall be made available by the contractor at his own cost in the field laboratory.
- xxv. The Contractor shall maintain all the work in good condition till the completion of entire work. The Contractor shall be responsible for and shall make good, all damages and repairs, rendered necessary due to fire, rain, traffic, floods or any other causes. The Engineer-in-Charge shall not be responsible for any claims for injuries to person/workmen or for structural damage to property happening from any neglect, default, want of proper care or misconduct on the part of the Contractor or of any other of his representatives, in his employment during the execution of the work. The compensation, if any, shall be paid directly to the Department / authority / persons concerned, by the Contractor at his own cost. Nothing extra shall be paid on this account.

1.98. The agency shall submit a 'Methods statement' for each important activity for the approval of the Engineer-in-charge soon after the award of work to him. The 'Methods statement' is a statement by which the construction procedures for any activity of construction are formulated and stated in chronological order. The 'Methods statement', should have a description of the item with elaborate procedures in steps to implement the same, the specifications of the materials involved, their testing and acceptance criteria, equipment to be used, Precautions to be taken, steps of measurement, etc.

1.99. As and when any important item is taken up for execution, the Agency shall submit the specifications and develop a checklist and Pour card. This sample checklist should be got approved from the Engineer-in-charge and should be used at site. This check list should be shown to the Engineer-in-charge or his/her designee during inspection. This procedure is to be followed for all hidden items, CC/RCC work, Steel-reinforcement, shuttering, cast-in-situ mosaic flooring, doors & windows, plumbing, including water supply pipe lines, roof treatment, earth filling etc.

1.100. The agency shall render all help and assistance in documenting the total sequence of this project by way of photography, slides, audio-video recording etc. Nothing extra shall be payable to the agency on this account.

1.101. SUBMISSION AND DOCUMENTATION

The Contractor shall render all help and assistance in documenting the total sequence of this project by way of photography, slides, audio/video recording etc. Nothing extra shall be payable to Contractor on this account. The original films shall be the property of the Department. No copy shall be prepared without the prior approval of the Engineer-in-Charge.

- i. The Contractor shall display all permissions, licenses, registration certificates, bar charts, other statements etc under various labour laws and other regulations applicable to the works, at his site office. He should also keep at site at least one set of BIS Codes and other relevant codes at site and produce the same if asked for by Engineer- In-Charge. In case of non compliance, these codes will be purchased from the Market and actual cost of purchase will be recovered from the next RA Bill of the Contractor.
- ii. The Contractor shall make available four (04) sets of completed Building Drawings, "As Built Drawings" along with literatures, manuals, warranty certificates etc. of various installed fittings, fixtures and equipment for the completed projects. This shall be the prerequisite for payment of final bill.
- iii. The Contractor shall make available three (03) sets of all drawings of internal and external services i.e. Water Supply, Sanitary line and Drainage lines. This shall be the prerequisite for payment of final bill. These drawings shall have the following information:
 - iv. Run off for all piping and their diameters including soil, waste pipes and vertical stacks.
 - v. Ground and invert level of all drainage pipes together with locations of all manholes and connections, up to outfall.
 - vi. Run off for all water supply lines with diameters location of control valves, access panels etc.
- vii. The contractor shall make available four (04) sets of computerized Standard Measurement Books (SMBs) having measurement of all the permanent standing in a building.
- viii. The Performance Guarantee shall not be released to the contractor until the aforesaid drawings are submitted to the Engineer-in-Charge
- ix. The contractor will submit computerized measurement sheet for the work carried out by him for making payment as per Clause – 6A of the CPWD General Conditions of Contract 2014 (with upto date correction slips). For casting of RCC members and other hidden items the corrected and duly test checked measurement sheets of reinforcement or that of other hidden items shall be deposited with Engineer in charge or his authorized representative, before casting of RCC or other hidden items. The delay in submission of corrected and duly checked measurement sheet may, therefore, delay casting of RCC or execution of hidden item for which no hindrance shall be recorded.
- x. To avoid delay, contractor should submit all samples well in advance so as to give timely orders for procurement.

1.102. PROGRAM/SCHEDULE

The Contractor shall prepare an integrated program chart within fifteen days of issue of award letter including civil as well as E & M activities for the execution of work, showing clearly all activities from the start of work to completion, with details of manpower, equipment and machinery required for the fulfilment of the program within the stipulated period and submit the same for approval of the Engineer-In-Charge within fifteen days of the award of the work. The integrated program chart so submitted should not have any discrepancy with the physical milestones attached in the contract agreement. The program chart should include the following:-

- i. Descriptive note explaining sequence of various activities.
- ii. Construction Program prepared on PRIMAVERA Software, which will indicate resources in financial terms, manpower and specialized equipment for every important stage.
- iii. Program for procurement of materials by the contractor.
- iv. Program for arranging and deployment of manpower both skilled and unskilled so as to achieve targeted progress.
- v. Program of procurement of machinery/equipment having adequate capacity, commensurate with the quantum of work to be done within the stipulated period, by the contractor.
- vi. Program for achieving fortnightly micro milestones and periodic milestones.
- vii. In case of non compliance/delay in compliance in this, a penalty @ Rs 10,000/- per day will be imposed which will be recovered from the immediate next R/A Bill of the Contractor.
- viii. If at any time, it appears to the Engineer-In-Charge that the actual progress of work

- does not conform to the approved program referred above, the contractor shall produce a revised program showing the modifications to the approved program by additional inputs to ensure completion of the work within the stipulated time.
- ix. The submission for approval by the Engineer-In-Charge of such program or the furnishing of such particulars shall not relieve the contractor of any of his duties or responsibilities under the contract. This is without prejudice to the right of Engineer-In-Charge to take action against the contractor as per terms and conditions of the agreement.
 - x. Apart from the above integrated program chart, the contractor shall be required to submit monthly progress report of the work in computerized form on 1st and 16th of every month. These Monthly progress reports shall be accompanied with photographs (at least ten nos.) of the work done at all the parts of construction site in a computerized form besides forwarding hard copies of the same before to Engineer in Charge. The contractor shall submit the 5 minute compiled video in soft copy of execution of different items of work along with the monthly progress report.
 - a) Construction schedule of the various components of the work through a bar chart for the next two fortnights (or as may be specified), showing the micro- milestone/milestones, targeted tasks (including material and labour requirement) and up to date progress. At least 10 digital photographs showing all the parts of construction site along with at least 5 minutes video of executions of different items in soft copy has to be submitted in every fortnightly progress report.
 - b) Progress chart of the various components of the work that are planned and achieved, for the fortnight as well as cumulative up to the fortnight under reckoning, with reason for deviations, if any in a tabular format.
 - c) Plant and machinery statement, indicating those deployed in the work.
 - d) Man-power statement indicating:
 - Individually the names of all the staff deployed on the work, along with their designations.
 - No. of skilled workers (trade wise) and total no. of unskilled workers deployed on the work and their location of deployment i.e. blocks.
 - xi. Financial statement, indicating the broad details of all the running account payment received up to date, such as gross value of work done, advances taken, recoveries effected, amount withheld, net payments detail of cheque payment received, extra/substituted/deviation items if any, etc.
 - a) In case of non compliance / delay in compliance in submission of fortnightly, a penalty @ Rs. 10,000/- per fortnightly report will be imposed which will be recovered from the immediate next R/A Bill of the Contractor.
 - b) For completing the work in time, the Contractor might be required to work in two or more shifts (including night shifts). No claim whatsoever shall be entertained on this account, notwithstanding the fact that the Contractor may have to pay extra amounts for any reason, to the labour and other staff engaged directly or indirectly on the work according to the provisions of the labour and other statutory bodies regulations and the agreement entered upon by the Contractor with them.
 - xii. The work should be planned in a systematic manner so as to ensure proper co-ordination of various disciplines viz. sanitary & water supply, electrical, fire fighting and any other services.
 - xiii. Other agencies will also simultaneously execute and install the works of sub-station / generating sets, air-conditioning, lifts, etc. for the work and the contractor shall afford necessary facilities for the same. The contractor shall leave such recesses, holes, openings trenches etc. as may be required for such related works (for which inserts, sleeves, brackets, electrical conduits, base plates, clamps etc. shall be supplied free of cost by the department unless otherwise specifically mentioned) and the contractor shall fix the same at time of casting of concrete, stone work and brick work, if required, and nothing extra shall be payable on this account.
 - xiv. The Contractor shall do proper sequencing of the various activities by suitably staggering the activities within various pockets in the plot so as to achieve early completion. The agency may deploy adequate equipment, machinery and labour as required for the completion of the entire work within the stipulated period specified. Also ancillary facilities shall be provided commensurate with requirement to complete the entire work within the stipulated period. Nothing extra shall be payable

on this account. Adequate number/sets of equipment in working condition, along with adequate stand-by arrangements, shall be deployed during entire construction period. It shall be ensured by the Contractor that all the equipment, Tools & Plants, machineries etc. provided by him are maintained in proper working conditions at all times during the progress of the work and till the completion of the work. Further, all the constructional tools, plants, equipment and machineries provided by the Contractor, on site of work or his work shop for this work, shall be exclusively intended for use in the construction of this work and they shall not be shifted / removed from site without the permission of the Engineer-in-Charge. Delay caused due to repairing or maintenance of Equipment, tools and other machineries shall be entirely attributed to the contractor. Extension of time shall not be given on this account to the contractor.

- xv. To avoid delay, contractor should submit samples well in advance so as to give timely orders for procurement.
- xvi. All material shall only be brought at site as per program finalized with the Engineer-in-Charge. Any pre-delivery of the material not required for immediate consumption shall not be accepted and thus not paid for (in terms of secured advance or advance payment etc.).

1.103. TEMPORARY WATER / ELECTRICITY / TELEPHONE CONNECTION

- i. Arrangement of temporary telephone connection, water and electricity required by him, shall be made by the Contractor at his own cost and also necessary permissions shall be obtained by him directly from concerned authorities, under intimation to the Department. Also, all initial cost and running charges, and security deposit, if any, in this regard shall be borne by him. The Contractor shall abide by all the rules/ bye laws applicable in this regard and he shall be solely responsible for any penalty on account of violation of any of the rules /byelaws in this regard. Nothing extra shall be payable on this account. The contractor shall make his own arrangement of water for completion of work. He may bring water from outside through tankers from authorized sources.
- ii. The Contractor shall be responsible for maintenance and watch and ward of the complete installation and water / electricity meter and shall also be responsible for any pilferage, theft, damage, penalty etc. in this regard. The Contractor shall indemnify the Department against any claim arising out of pilferage, theft, damage, penalty etc. whatsoever on this account. Security deposit for the work shall be released only after No Dues Certificates are obtained from the local Authorities from whom temporary electric/ water / telephone connection have been obtained by the Contractor. Nothing extra shall be payable on this account.
- iii. The Department shall in no way be responsible for either any delay in getting electric and/or water and/or telephone connections for carrying out the work or not getting connections at all. No claim of delay or any other kind, whatsoever, on this account shall be entertained from the Contractor. Also contingency arrangement of stand-by water & electric supply shall be made by the Contractor for commencement and smooth progress of the work so that work does not suffer on account of power failure or disconnection or not getting connection at all. No claim of any kind whatsoever shall be entertained on this account from the Contractor. Nothing extra shall be payable on this account.

1.104. CLEANLINESS OF SITE

- i. The Contractor shall not stack building material / malba / muck on the land or road of the local development authority or on the land owned by the others, as the case may be. So the muck, rubbish etc. shall be removed periodically, from the site of work to the approved dumping grounds as per the local byelaws and regulations of the concerned authorities and all necessary permissions in this regard from the local bodies shall be obtained by the Contractor. Nothing extra shall be payable on this account. In case, the Contractor is found stacking the building material / malba as stated above, the Contractor shall be liable to pay the stacking charges / penalty as may be levied by the local body or any other authority and also to face penal action as per the rules, regulations and bye-laws of such body or authority. The Engineer –in-Charge shall be at liberty to recover, such sums due but not paid to the concerned authorities on the above counts, from any sums due to the Contractor including amount of the Security Deposit and performance guarantee in respect of this contract agreement.

- ii. The contractor shall take instructions from the Engineer-In-Charge regarding collection and stacking of materials at any place. No excavated earth or building rubbish shall be stacked on areas where other buildings, roads, services and compound walls are to be constructed.
- iii. The site of work shall be always kept clean due to constraints of space and to avoid any nuisance to the users of buildings in the adjacent plots. The Contractor shall take all care to prevent any water- logging at site. The wastewater, slush etc. shall not be allowed to be collected at site. It may be directly pumped into the creek with prior approval of the concerned authorities. For discharge into public drainage system, necessary permission shall be obtained from relevant authorities after paying the necessary charges, if any, directly to the authorities. The work shall be carried out in such a way that the area is kept clean and tidy. All the fees/charges in this regard shall be borne by the Contractor. Nothing extra shall be payable on this account.
- iv. It is the responsibility of contractor to keep basement neat and clean. The contractor shall spray the chemicals to check the mosquitoes at frequent interval or as directed by the Engineer in charge. The contractor shall also make lighting and temporary ventilation arrangement in basement. The contractor shall provide submersible pumps with automatic on/off system in each sump in lower basement to bail out the water accumulated. The contractor shall quote rates after considering the above sated conditions and nothing extra shall be paid on this account.
- v. The contractor shall not wash the drum of TM (transit mixture) at site and shall avoid the spread of leachate / cementslurry to bespreadat the site ofworkandallcareshall be takentokeep thesite neatand cleanathisowncost.

1.105. INSPECTION OFWORK

- i. In addition to the provisions of relevant clauses of the contract, the work shall also be open to inspection by Senior Officers of CPWD & the representative of the Consultants, the contractor shall at times during the usual working hours and at all times at which reasonable notices of the intention of the Engineer-in-charge or other officers as stated above to visit the works shall have been given to the contractor, either himself be present to receive the orders and instructions or have a responsible representative duly accredited in writing, to be present for that purpose.
- ii. Inspectionof the workbyConsultantappointedbythe PIU.
 - a) The consultant appointed by PIU, shall be inspecting the works including workshops and fabrication factory to ensure that the works are in general being executed according to the design, drawings and specifications laid down in the contract. His observations shall be communicated by PIU engineering staff and compliance is to be reported to PIU.
 - b) The consultant appointed by PIU shall certify on completion of particular building that it has been constructed according to the approved drawings design andspecifications.
- iii. SeniorOfficersof PIU,Dignitaries from Health and Family Welfare Departmentsshallbe inspectingtheon-going workat siteatany timewithorwithoutpriorintimation.Thecontractorshall, therefore, keepupdatedthe followingrequirementsanddetailing.
 - a) Display Board showing detail of work, weekly progress achieved with respect to targets, reason of shortfall, status of manpower, wages being paid for different categories of workers.
 - b) Entrance and area surrounding to be kept cleaned.
 - c) Display layout plan key plan, Building drawings including plans, elevations and sections
 - d) Upto date displays of Bar chart, CPM and PERT etc.
 - e) Keep details of quantities executed, balance quantities, deviations, possible Extra item, substituted Item etc
 - f) Keep plastic / cloth mounted one sets of building drawings.
 - g) Set of Helmets and safety shoes for exclusive use for officers/dignitaries visiting atsite.

1.106. FINAL TESTINGOF THE INSTALLATION

The Contractor shall demonstrate trouble free functioning of all the Civil and E & M installations and services. The Engineer-in-Charge or his authorized representatives shall carry out

final inspection of the various Civil and E & M services and installations. Any defect(s) noticed during demonstration shall be rectified by the Contractor at his own cost to the entire satisfaction of the Engineer-in-Charge. Nothing extra shall be payable on this account.

1.107. SUBMISSION OF AS BUILT DRAWINGS AND OBTAINING OCCUPATION CERTIFICATE

The contractor shall coordinate and facilitate consultant for obtaining occupation certificate / completion certificate from local bodies including getting the required site visits conducted by such authorities with a view to obtain the same.

1.108. DEFECT LIABILITY PERIOD (REFUND OF SECURITY DEPOSIT)

The clause 17 of the General Conditions of Contract for PIU/CPWD works shall be applied.

1.109. DEALING WITH INCONSISTENT RATES

- i. The contractor shall quote percentage rate as per General condition of Contract of PIU/CPWD-7.
- ii. Wherever any reference to any Indian Standards occurs in the documents relating to this contract, the same shall be inclusive of all amendments issued thereto or revisions thereof, if any, up to the date of receipt of Bids.
- iii. Unless otherwise specified in the schedule of quantities, the rates for all items of work shall be considered, as inclusive of pumping out or bailing out water, if required throughout the construction period for which no extra payment shall be made. This shall also include water encountered from any source such as rains, floods, or any other cause whatsoever except sub soil water table being high.
- iv. All stone aggregate and stone ballast shall be of hard stone variety to be obtained from approved quarries.
- v. Coarse sand should be obtained from approved sources. The same shall be clean and sharp angular grit type. The coarse sand shall be screened before using, if required. If the sand brought to site is dirty, it must be washed in clean water to bring the sand to the required specifications. Nothing extra shall be payable on this account.
- vi. The rates for all items of work, shall unless clearly specified otherwise, include cost of all operations and all inputs of labour, material, T & P, scaffolding, wastages, watch and ward, other inputs, all incidental charges, all taxes, cess, VAT, duties, levies etc. required for execution of the work.

1.110. PRODUCT DELIVERY, STORAGE AND HANDLING OF CHEMICALS

- i. The contractor shall construct storage space for Chemicals materials to ensure that the storage conditions are as recommended by the manufactures.
- ii. All the materials shall be procured and delivered in sealed containers with labels legible and intact.
- iii. All the chemicals {polymers, epoxy, water proofing compound, plasticizer, Polysulphide, SBR based elastomeric, all exterior and interior paints, polish etc.) shall be procured in convenient packs say 20 litres/Kgs.} capacity packing only or as approved by the Engineer-in-Charge, and not in bigger capacity containers, say 200 litre (Kgs.) drums unless otherwise specifically permitted by the Engineer-in-Charge. One sample from each lot of the chemical procured by the contractor shall be tested in a laboratory as approved by the Engineer-in-charge.
- iv. All material required for the execution of the work shall be got approved, procured and deposited with the Departmental supervisory staff. The materials shall be kept in joint custody of the contractor and the Department. The watch and ward of such material shall, however, remain to be the responsibility of the contractor and no claim, whatsoever, on this account shall be entertained. Different containers of each chemical shall be serially numbered on packing and also consumed in that order. Day-to-Day account of receipt, issue and balance shall be regulated by the Department and proper account shall be maintained at site of work in the prescribed form as per the standard practice.
- v. All the chemicals shall be procured by the contractor directly from the manufacturer. In exceptional circumstances, the contractor may be allowed to procure the materials from the authorized dealers of the manufacturers, if specifically permitted by the Engineer-in-Charge.
- vi. The original copies of challan/cash memos towards the quantity of various chemicals procured shall be made available by the contractor at the request from the Engineer-in-

- Charge and a copy of the same shall be kept in record.
- vii. The Name of manufacturers, manufacturer's product identification, manufacturer's mixing instructions, warning for handling and toxicity and date of manufacturing and self life shall be clearly and legibly mentioned on the labels of the each container.
 - viii. The contractor shall submit for the chemicals procured, manufacturer's and / or authorized dealer's certificate regarding supplying and verifying conformance to the material specifications, as specified.
 - ix. All filled containers shall be handled in safe manner and in a way to avoid breaking container seals.
 - x. Empty containers of the chemicals should not be removed from site till the completion of work and shall be removed only with the written approval of the Engineer-in-Charge.
 - xi. All arrangements for measuring, dosing and mixing of material / chemicals at site have to be made by the contractor. Contractor shall suitably advise his site Engineer and all the workers as regards safe handling of chemicals. Necessary protective and safety equipments in form of hand gloves, goggles etc. shall be provided by the contractor and be also used at site.
 - xii. All incidental charges of any kind including cartage, storage and wastage and safe custody of material etc. shall be borne by the contractor and no claim, whatsoever, shall be entertained on this account.
 - xiii. The chemicals shall be tested in an independent laboratory as approved by the Engineer-in-charge at the frequency as specified. If required, more samples may have to be tested as per the directions of the Engineer-in- Charge. Nothing extra shall be payable on this account. However testing charges shall be borne by the department for the samples satisfying the requirements specified in the Bid.

1.111. DE-WATERING

- i. De-watering required, if any, shall be done conforming to BIS Code IS: 9759 (guide lines for de-watering during construction) and / or as per the specifications approved by the Engineer-in-Charge. Design of an appropriate and suitable dewatering system shall be the Contractor's responsibility. Such scheme shall be modified / augmented as the work proceeds based on fresh information discovered during the progress of work, at no extra cost. At all times during the construction of work, efficient drainage bailing of water for lowering of sub-soil water table in all situations for construction of any type of item at site to complete the project shall be carried out by the Contractor and the Contractor shall also ensure that there is no danger to the nearby properties and installations on account of such lowering of water table. If needed, suitable precautionary measures shall be taken by the Contractor. Also the scheme of dewatering adopted shall have adequate built in arrangement to serve as stand-bye to attend to repair of pumps etc. and disruption of power / fuel supply. Nothing extra shall be payable on this account.
- ii. In trenches where surface water is likely to get into cut / trench during monsoons, a ring bund of puddle clay or by any other means shall be formed outside, to the required height, and maintained by the Contractor. Also, suitable steps shall be taken by the Contractor to prevent back flow of pumped water into the trench. Nothing extra shall be payable on this account.

1.112. INSURANCE POLICIES

Before commencing the execution of work, the Contractor shall, without in any way limiting his obligations and liabilities, insure at his own cost and expense against any damage or loss or injury, which may be caused to any person or property, at site of work. The Contractor shall obtain and submit to the Engineer-in-Charge proper Contractor All Risk Insurance Policy for an amount 1.25 times the contract amount for this work, with Engineer-in-Charge as the first beneficiary. The insurance shall be obtained in joint names of Engineer-in-Charge and the Contractor (who shall be second beneficiary). Also, he shall indemnify the Department from any liability during the execution of the work. Further, he shall obtain and submit to the Engineer-in-Charge, a third party insurance policy for maximum Rs.10 lakh for each accident, with the Engineer-in-Charge as the first beneficiary. The insurance shall be obtained in joint names of Engineer-in-Charge and the Contractor (who shall be second beneficiary). The Contractor shall, from time to time, provide documentary evidence as regards payment of premium for all the Insurance Policies for keeping them valid till the completion of the work.

The Contractor shall ensure that Insurance Policies are also taken for the workers of his Sub-Contractors/ specialized agencies also. Without prejudice to any of its obligations and responsibilities specified above, the Contractor shall within 10 days from the date of letter of acceptance of the Bid and thereafter at the end of each quarter submit a report to the Department giving details of the Insurance Policies along with Certificate of these insurance policies being valid, along with documentary evidences as required by the Engineer-in-Charge. No work shall be commenced by the Contractor unless she obtains the Insurance Policies as mentioned above. Also, no payments shall be made to the Contractor on expiry of insurance policies unless renewed by the Contractor. Nothing extra shall be payable on this account. No claim of hindrance (or any other claim) shall be entertained from the Contractor on these accounts.

The contractor shall arrange at no extra cost to the Department to train two persons from the department (CPWD) and two person from the client, one each for civil and electrical works, on how to operate and carry out preventive maintenance of the systems (both civil and electrical). The contractor shall arrange this training from well qualified and experienced personnel for the period as required.

1.113. PRESERVE AND PROTECT LANDSCAPE DURING CONSTRUCTION

- i. The contractor shall ensure that no trees, existing or otherwise, shall be harmed and damage to roots should be prevented during trenching, placing backfill, driving or parking heavy equipment, dumping of trash, oil, paint, and other materials detrimental to plant health. These activities should be restricted to the areas outside of the canopy of the tree, or, from a safe distance from the tree/plant by means of barricading. Trees will not be used for support; their trunks shall not be damaged by cutting and carving or by nailing posters, advertisements or other material. Lighting of fires or carrying out heat or gas emitting construction activity within the ground, covered by canopy of the tree is not to be permitted.
- ii. The contractor shall take steps to protect trees or saplings identified for preservation within the construction site using tree guards of approved specification.
- iii. Contractor should limit all construction activity within the specified area as per the Construction Management Plan (CMP) approved by Engineer in Charge.
- iv. The contractor shall avoid cut and fill in the root zones, through delineating and fencing the drip line (the spread limit of a canopy projected on the ground) of all the trees or group of trees. Separate the zones of movement of heavy equipment, parking, or excessive foot traffic from the fenced plant protection zones.
- v. The contractor shall ensure that maintenance activities during construction period shall be performed as needed to ensure that the vegetation remains healthy.

1.114. Contractor shall be required to develop and implement a waste management plan, quantifying material diversion goals. He shall establish goals for diversion from disposal in landfills and incinerators and adopt a construction waste management plan to achieve these goals. A project-wide policy of nothing leaves the Site should be followed, in such a case when strictly followed, care would automatically be taken in ordering and timing of materials such that excess doesn't become waste. The Contractor's ingenuity is especially called towards meeting this prerequisite/credit (as per IGBC, GREEN New Building Rating System Version 3.0 & GRIHA, MNRE). Consider recycling cardboard, metal, brick, acoustic tile, concrete, plastic, clean wood, glass, gypsum wallboard, carpet and insulation. Designate a specific area(s) on the construction site for segregated or commingled collection of recyclable material, and track recycling efforts throughout the construction process. Identify construction haulers and recycler to handle the designated materials. The diversion may include donation of material to charitable organizations and salvage of material on-site.

- 1.115.** Contractor shall collect all construction waste generated on site. Segregate these wastes based on their utility and examine means of sending such waste to manufacturing units which use them as raw material or other site which require it for specific purpose. Typical construction debris could be broken bricks, steel bars, broken tiles, spilled concrete and mortar etc.
- 1.116.** The contractor shall provide potable water for all workers.
- 1.117.** The contractor shall provide the minimum level of sanitation and safety facilities for the workers at site. The contractor shall ensure cleanliness of workplace with regard to the disposal of waste and effluent; provide clean drinking water and latrines and urinals as per applicable standard. Adequate toilet facilities shall be provided for the workman with easy access of their place of work. The total no. to be provided shall not be less than 1 per 30 employees in any one shift. Toilet facilities shall be provided from the start of building operations, connection to a sewer shall be made as soon as practicable. Every toilet shall be so constructed that the occupant is sheltered from view and protected from the weather and falling objects. Toilet facilities shall be maintained in a sanitary condition. A sufficient quantity of disinfectant shall be provided. Natural or artificial illumination shall be provided.
- 1.118.** Water spray, through a simple hose for small projects, to keep dust under control is to be used. Fine mist should be used to control fine particulate. However, this should be done with care so as not to waste water. Heavy watering can also create mud, which when tracked on paved public roadways, must be promptly removed. Also, there must be an adequate supply of clean water nearby to ensure that spray nozzles don't get plugged.
- 1.119.** Contractor shall be required to provide an easily accessible area that serves the entire building and is dedicated to the separation, collection and storage of materials for recycling including (at a minimum) paper, corrugated cardboard, glass, plastics, and metals. He shall coordinate the size and functionality of the recycling areas with the anticipated collection services for glass, plastic, office paper, newspaper, cardboard, and organic waste to maximize the effectiveness of the dedicated areas. Consider employing cardboard balers, aluminium can crushers, recycling chutes, and collection bins at individual workstation to further enhance the recycling program.
- 1.120.** Staging (dividing a construction area into two or more areas to minimize the area of soil that will be exposed at any given time) should be done on separate undisturbed land from land disturbed by construction activity and material storage.
- 1.121.** The contractor shall comply with the safety procedures, norms and guidelines (as applicable) as outlined in the document Part 7 Constructional practices and safety of National Building code 2016 of India, Bureau of Indian Standards. A copy of all pertinent regulations and notices concerning accidents, injury and first-aid shall be prominently exhibited at the work site. Depending upon the scope & nature of work, a person qualified in first-aid shall be available at work site to render and direct first-aid to casualties. A telephone may be provided to first-aid assistant with telephone numbers of the hospitals displayed. Complete reports of all accidents and action taken thereon shall be forwarded to the competent authorities.
- 1.122.** The contractor shall ensure the following activities for construction workers safety, among other measures:
- Guarding all parts of dangerous machinery.
 - Precautionary signs for working on machinery
 - Maintaining hoists and lifts, lifting machines, chains, ropes, and other lifting tackles in good condition.
 - Durable and reusable formwork systems to replace timber formwork and ensure that formwork where used is properly maintained.
 - Ensuring that walking surfaces or boards at height are of sound construction and are provided with safety rails or belts.

- vi. Provide protective equipment; helmets etc. –
- vii. Provide measures to prevent fires. Fire extinguishers and buckets of sand to be provided in the fire- prone area and elsewhere.
- viii. Provide sufficient and suitable light for working during night time.

1.123. The storage of material shall be as per standard good practices as specified in Part 7, Section 2 in Storage, Stacking and Handling practices, NBC 2016 and shall be to the satisfaction of the Engineer in Charge to ensure minimum wastage and to prevent any misuse, damage, inconvenience or accident. Watch and ward of the Contractor's materials shall be his own responsibility. There should be a 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 materials. While planning the layout, the requirements of various materials, components and equipment's at different stages of construction shall be considered.

1.124. The contractor shall provide for a adequate number of garbage bins around the construction site and the workers facilities and will be responsible for the proper utilization of these bins for any solid waste generated during the construction. The contractor shall ensure that the site and the workers facilities are kept litter free. Separate bins should be provided for plastic, glass, metal, biological and paper waste and labelled in both Hindi and English with suitable symbols.

1.125. The Contractor shall remove from site all rubbish and debris generated by the Works and keep Works clean and tidy throughout the Contract Period. All the serviceable and non-serviceable (malba) materials shall be segregated and stored separately. The malba obtained during construction shall be collected in well-formed heaps at properly selected places, keeping in a view safe condition for workmen in the area. Materials which are likely to cause dust nuisance or undue environmental pollution in any other way, shall be removed from the site at the earliest and till then they shall be suitably covered. Glass & steel should be dumped or buried separately to prevent injury. The work of removal of debris should be carried out during day. In case of poor visibility artificial light may be provided.

1.126. The contractor shall provide O&M Manuals wherever applicable.

1.127. The contractor shall make himself conversant with the Site Waste Management Program Manual and actively contribute to its compilation by estimating the nature and volume of waste generated by the process/installation in question.

1.128. The contractor shall prepare and submit spill prevention and control plans before the start of construction, clearly stating measures to stop the source of the spill, to contain the spill, to dispose the contaminated material and hazardous wastes, and stating designation of personnel trained to prevent and control spills. Hazardous wastes include pesticides, paints, cleaners, and petroleum products.

1.129. Contractor shall collect & submit the relevant material certificates for materials with high recycled (both post-industrial and post-consumer) content, including materials like RMC mix with fly-ash, glass with recycled content, calcium silicate boards etc.

1.130. Contractor shall collect the relevant material certificates for rapidly renewable materials such as bamboo, wool, cotton insulation, agri-fiber, linoleum, wheat board, strawboard and cork etc.

1.131. Where possible, the contractor shall select materials / vendors, harvested and manufactured regionally, within a 800-km radius of the project site.

1.132. The contractor shall ensure that a flush out of all internal spaces is conducted prior to handover. This shall comprise an opening of all doors and windows for 14 days to vent out any toxic fumes due to paints, varnishes, polishes, etc.

1.133. Wherever required, Contractor shall meet and carry out of all activities on site, supplementation of information, and submittals in accordance with IGBC GREEN New

Building Rating System Version 3.0 & GRIHA program standards and guidelines. Towards meeting the aforementioned building environmental rating standard(s) expert assistance shall be provided to him up on request.

1.134. CONSTRUCTION WASTE

- i. Contractor shall ensure that wastage of construction material is within 3%.
- ii. All construction debris generated during construction shall be carefully segregated and stored in a demarcated waste yard. Clear, identifiable areas shall be provided for each waste type. Employ measures to segregate the waste on site into inert, chemical, or hazardous wastes.
- iii. All construction debris shall be used for back filling / disposal from site etc, as per the instructions of the Engineer in Charge, with necessary activities of sorting, crushing, etc.
- iv. No construction debris shall be taken away from the site, without the prior approval of the Engineer in Charge.
- v. The contractor shall recycle the unused chemical/hazardous wastes such as oil, paint, batteries, and asbestos.
- vi. If and when construction debris is taken out of the site, after prior permissions from the Engineer-in-Charge, then the contractor shall ensure the safe disposal of all wastes and will only dispose of any such construction waste in approved dumping sites.

1.135. Additional Information to be provided by Contractor

- i. The contractor shall, during the entire tenure of the construction phase, maintain the following records and submit to the Engineer in Charge:
 - i. Water consumption in liters
 - ii. Electricity consumption in 'kwh' units
 - iii. Diesel consumption in liters
 - iv. Quantum of waste (volumetric/weight basis) generated at site and these segregated waste types divided into inert, chemical and hazardous wastes.
 - v. Digital photo documentation to demonstrate compliance of safety guidelines as specified in the document.
- ii. The contractor shall, during the entire tenure of the construction phase, maintain the following records and submit to the Engineer in Charge on demand:
 - i. Quantities of material brought into the site, including the material issued to the contractor by the Engineer in charge.
 - ii. Quantities of construction debris (if at all) taken out of the site
 - iii. Digital photographs of the works at site, the workers facilities, the waste and other material storage yards, pre-fabrication and block making works, etc as guided by the Engineer in Charge
- iii. The contractor shall submit a document after construction of the buildings, a brief description along with photographic records to show that other areas have not been disturbed during construction. The documents should also include brief explanation and photographic records to show erosion and sedimentation control measures adopted. (Document CAD drawings showing site plan details of existing vegetation, existing buildings, existing slopes and site drainage pattern, staging and spill prevention measures, erosion and sedimentation control measures and measures adopted for top soil preservation during construction)
- iv. The contractor shall submit to the Engineer in Charge, before the start of construction, a site plan along with a narrative to demarcate areas on site from which top soil has to be gathered, designate area where it will be stored, measures adopted for top soil preservation and indicate areas where it will be reapplied after construction is complete.
- v. The contractor shall submit to the Engineer in Charge, a detailed narrative (not more than 250 words) on provision for safe drinking water and sanitation facility for construction workers and site personnel.
- vi. Provide supporting document from the manufacturer of the pre-cast building blocks specifying the fly ash content of the blocks used in an infill wall system.
- vii. The contractor shall submit to the Engineer in Charge, following information, for all material brought to site for construction purposes, including manufacturer is certifications, verifying information, and test data, where Specifications sections require data relating to environmental issues including but not limited to:
 - a) Source of products: Supplier details and location of the supplier.

- b) Project Recyclability: Submit information to assist Owner and Contractor in recycling materials involved in shipping, handling, and delivery, and for temporary materials necessary for installation of products.
 - c) Recycled Content: Submit information regarding product post- industrial recycled and post-consumer recycled content. Use the recycled Content Certification Form, to be provided by the Commissioning Authority appointed for the Project.
 - d) Product Recyclability: Submit information regarding product and product's component's recyclability including potential sources accepting recyclable materials wherever applicable.
- viii. Provide final certification of well-managed forest of origin to provide final documentation of certified sustainably harvested status: Acceptable wood certified sustainably harvested certification shall include:
 - a) Wood suppliers certificate issued by one of the Forest Stewardship Council- accredited certifying agencies;
 - b) Suppliers invoice detailing the quantities of certified wood products for project;
 - c) Letter from one of a certifying agency corroborating that the products on the wood supplier is invoice originate from certified well-managed forests.
- ix. Cleantech: Provide pollution clearance certificates from all manufacturers of materials.
- x. Indoor Air Quality and Environmental Issues: Submit emission test data, sourced from the manufacturers, produced by acceptable testing laboratory listed in Quality Assurance Article for materials as required in each specific Specification section.
 - a) Certifications from manufacturers of Low VOC paints, adhesives, sealant and polishes used at this particular project site.
 - b) Certification from manufacturers of composite wood products/agro fiber products on the absence of added urea formaldehyde resin in the products supplied to them to this particular site.
 - c) Submit environmental and pollution clearance certificates for all diesel generators installed as part of this project.
- xi. Provide total support to Engineer in Charge and Green Building Consultants appointed by the Engineer in charge in completing all Green Building Rating related formalities, including signing of forms, providing signed letters in the contractor's letterhead whenever required.
- xii. The contractor is expected to go through all other conditions of the IGBC GREEN New Building Rating System Version 3.0 & GRIHA rating stipulations. Failure to adhere to any of the above mentioned items, without approval of the Engineer-in-Charge, shall be deemed as a violation of contract and the contractor shall be held liable for penalty as per terms of the agreement.

2. SPECIAL CONDITIONS FOR GREEN BUILDING

The building is registered for obtaining GRIHA Rating from GRIHA Secretariat under MNRE scheme to obtain 3 star rating and IGBC GREEN New Building Rating system version 3.0 as GOLD / PLATINUM & IGBC GREEN homes Rating system version 2.0 as GOLD / PLATINUM. Suitable IGBC rating system may be chosen as per the Project typology. The contractor is required to execute the work in a befitting manner to obtain the targeted GRIHA rating and IGBC GREEN New Building Rating system version 3.0 as GOLD / PLATINUM & IGBC GREEN homes Rating system version 2.0 as GOLD / PLATINUM.

Special conditions for GRIHA & IGBC rating:-

- 2.1. The contractor shall prepare scheme for the approval of Engineer -in- charge for obtaining GRIHA & IGBC rating in the criteria relevant to the execution of work as per advice of Green Building Consultant of main Consultant.
- 2.2. The contractor shall plan and execute the work in a manner to preserve and protect the landscape during construction and shall arrange the materials/equipment and follow the procedure as per criterion 2 of the GRIHA & IGBC rating as applicable.

2.3. All the mandatory criteria of GRIHA & IGBC and additional conditions for Green Building practices are to be necessarily followed for entire academic parcel.

2.4. The contractor shall comply with NBC norms on construction safety, health and sanitation as per criterion 8

2.5. The construction activity shall be done in a befitting manner and the contractor shall adopt measures to prevent air pollution at site in compliance with criterion 9 of GRIHA & IGBC rating as applicable.

2.6. The contractor shall comply with all the instructions and schemes for execution of green building.

2.7. Nothing shall be paid extra for fulfilment of all these conditions except for the items existing in the schedule of quantities. For such items work done shall be paid on the basis of the agreement rates.

2.8. Pre-construction Stage

2.8.1. Construction Vehicles, Equipment and Machinery

- i. All vehicles, equipment and machinery to be procured for construction shall conform to the relevant Bureau of India Standard (BIS) norms.
- ii. Emission from the vehicles must conform to environmental norms.
- iii. Dust produced from the vehicular movement and other site activities is to be mitigated by sprinkling of water.
- iv. Noise limits for construction equipments shall not exceed 75 dB(A), measured at one meter from the edge of the equipment in free area, as specified in the Environment Protection Act, 1986, schedule VI part E, as amended on 9th May, 1993. The maximum noise levels near the construction sites should be limited to 65 dB (A) Leq(5min) in project area.

2.9. Construction Stage

2.9.1. Construction Wastes Disposal

- i. The pre-identified dump locations will be a part of solid waste management plan to be prepared by the Contractor in consultation with Engineer -in-charge.
- ii. Contractor shall get approved the location of disposal site prior to commencement of the excavation on any section of the project location.
- iii. Contractor shall ensure that any spoils of material will not be disposed off in any municipality solid waste collection bins.

2.10. Procurement of Construction Materials

- i. All vehicles delivering construction materials to the site shall be covered to avoid spillage of materials and maintain cleanliness of the roads.
- ii. Wheel Tyres of all vehicles used by of the contractor, or any of his sub contractor or materials supplies shall be cleaned and washed clear of all dust/mud before leaving the project premises. This shall be done by routing the vehicles through tyre washing tracks.
- iii. Contractor shall arrange for regular water sprinkling at least twice a day (i.e. morning and evening) for dust suppression of the construction sites and unpaved roads used by his construction vehicles.

2.11. Water Pollution

- i. The Contractor shall take all precautionary measures to prevent the wastewater during construction to accumulate anywhere.
- ii. The wastewater arising from the project is to be disposed off in the manner that is acceptable to the Engineer-in-charge.

2.12. Air and Noise Pollution

Contractor shall use dust screens and sprinkle water around the construction site to arrest spreading of dust in the air and surrounding areas.

- i. Contractor shall ensure that all vehicles, equipment and machinery used for construction are regularly maintained and confirm that emission levels comply with environmental emission standards/norms.
- ii. For controlling the noise from Vehicles, Plants and Equipments, the Contractor shall confirm the following:
 - a) All vehicles and equipment used in construction will be fitted with exhaust silencers.
 - b) Servicing of all construction vehicles and machinery will be done regularly and during routine servicing operations, the effectiveness of exhaust silencers will be checked and if found defective will be replaced.
 - c) Noise emission from compactors (rollers) front loaders, concrete mixers, cranes (movable), vibrators and saws should be less than 75 dB(A).
 - d) As per the standards/guidelines for control of Noise Pollution from Stationary Diesel Generator (DG) sets, noise emission in dB(A) from DG Set (15-500 KVA) should be less than $94 + 10 \log_{10} (\text{KVA})$. The standards also suggest construction of acoustic enclosure around the DG Set and provision of proper exhaust muffler with insertion loss of minimum 25 dB(A) as mandatory.

2.13. Personal Safety Measures for Labour

Contractor will provide the following items for safety of workers employed by contractor and associate agencies:

- i. Protective footwear and gloves to all workers employed for the work on mixing, cement, lime mortars, concrete etc. and openings in water pipeline/sewer line.
- ii. Welder's protective eye-shields to workers who are engaged in welding works.
- iii. Safety helmet and Safety harness/ belt Provide adequate sanitation/safety facilities for construction workers to ensure the health and safety of the workers during construction, with effective provisions for the basic facilities such as sanitation, drinking water and safety equipments or machinery.
- iv. All the workers should be wearing helmet and shoes all the time on site.
- v. Masks and gloves should be worn whenever and wherever required.
- vi. Adequate drinking water facility should be provided at site, adequate number of decentralized latrines and urinals to be provided for construction workers.
- vii. If allowed Full time workers residing on site, then they should be provided with clean and adequate temporary hutment.
- viii. First aid facility should also be provided.
- ix. Overhead lifting of heavy materials should be avoided. Barrow wheel and hand-lift boxes should be used to transport materials onsite.
- x. Tobacco and cigarette smoking should be prohibited onsite.
- xi. All dangerous parts of machinery are well guarded and all precautions for working on machinery are taken.
- xii. Maintain hoists and lifts, lifting machines, chains, ropes and other lifting tackles in good condition. Provide safety net of adequate strength to arrest falling material down below.
- xiii. Use of durable and reusable formwork systems to replace timber formwork and ensure that formwork where used is properly maintained.
- xiv. Ensure that walking surfaces or boards at height are of sound construction and are provided with safety rails and belts. Provide protective equipments such as helmets.
- xv. Provide measure to prevent fire. Fire extinguisher and buckets of sand to be provided in fire-prone area and elsewhere.
- xvi. Provide sufficient and suitable light for working during night.
- xvii. Ensure that measures to protect workers from materials of construction, transportation, storage and other dangers and health hazards are taken
- xviii. Ensure that the construction firm/division/company have sound safety policies.
- xix. Comply with the safety procedure, norms and guidelines (as applicable) as outlined in NBC 2005 (BIS 2005c).
- xx. Adopt additional best practices and prescribed norms as in NBC 2005 (BIS 2005).

2.14. Identify road on-site that would be used for vehicular traffic. Update vehicular roads (if these are unpaved) by increasing the surface strength by improving particle size, shape and mineral type that make up the

surface base. Add surface gravel to reduce source of dust emission.
Limit amount of fine particles (smaller than 0.075mm) to 10 -20%. Limit vehicular speed on site 10km/h. Nothing extra will be payable for this.

2.15. All material storage should be adequately covered and contained so that they are not exposed to situations where wind on site could lead to dust/particulate emissions.

2.16. Spills of dirt or dusty materials shall be cleaned up promptly so the spilled material does not become a source of fugitive dust and also to prevent of seepage of pollutant laden water into the ground aquifers. When cleaning up the spill, ensure that the clean-up process does not generate additional dust. Similarly, spilled concrete slurries or liquid wastes should be contained/cleaned up immediately before they can infiltrate into the soil/ground or runoff in nearby areas.

2.17. Ensure that water spraying is carried out by wetting the surface by spraying water on:

- i. Any dusty material.
- ii. Areas where demolition work is carried out.
- iii. Any unpaved main-haul road and.
- iv. Areas where excavation or earth moving activities are to be carried out.

2.18. The contractor shall ensure the following:

- i. Cover and enclose the site by providing dust screen, sheeting or netting to scaffold along the perimeter of a building.
- ii. Covering stockpiles of dusty material with impervious sheeting.
- iii. Covering dusty load on vehicles by impervious sheeting before they leave the site.
- iv. Transferring, handling/storing dry loose materials like bulk cement and dry pulverized fly ash inside a totally enclosed system.
- v. Clear vegetation only from areas where work will start right away.
- vi. Vegetate / mulch areas where vehicles do not ply.
- vii. Apply gravel / landscaping rock to the areas where mulching/paving is impractical.

2.19. Adopt measures to prevent air pollution in the vicinity of the site due to construction activities. There is no standard reference for this. The best practices should be followed (as adopted from international best practice documents and codes).

2.20. Provide sheet covering/barricading of site of not less than 3m height along the site boundary, next to a road or other public area. Nothing extra will be paid for this.

2.21. The contractor shall provide experienced personnel with suitable training to ensure that these methods are implemented. Prior to the commencement of any work, the method of working, plant equipment and air pollution control system to be used on-site should be made available for the inspection and approval of the Engineer-in-Charge to ensure that these are suitable for the project.

2.22. Employ measures to segregate the waste on-site into inert, chemical or hazardous wastes. Recycle the unused chemical/hazardous wastes such as soil, paint, batteries and asbestos. The inert waste is to be disposed off to Municipal Corporation/local bodies dump yard and land fill sites.

2.23. To preserve the existing landscape and protect it from degradation during the process of construction. Select proper timing for construction activity to minimize the disturbances such as soil pollution due to spilling of the construction material and its mixing with rainwater. The construction management plan including soil erosion control management plans shall be prepared accordingly for each month. The application of erosion control measures includes construction of gravel pits and tyre washing bays of approved size and specification for all vehicular site entry/exits, protection of slopes greater than 10%. Sedimentation Collection System and runoff diversion systems shall be in place before the commencement of construction activity. Preserve and protect the existing vegetation by not-disturbing or damaging to specified site areas during construction.

- 2.24.** The Contractor should follow the construction plan as proposed by the Engineer-in-charge / landscape consultant to minimize the site disturbances such as soil pollution due to spilling. Use staging and spill prevention and control plan to restrict the spilling of the contaminating material on site.
- 2.25.** Spill prevention and control plans should clearly state measures to stop the source of the spill. Measures to contain the spill and measures to dispose the contaminated material and hazardous wastes. It should also state the designation of personnel trained to prevent and control spills. Hazardous wastes include pesticides, paints, cleaners and petroleum products.
- 2.26.** A soil Erosion and Sedimentation Control Plan (ESCP) should be prepared prior to construction and should be applied effectively.
- 2.27.** The contractor shall prepare and submit 'Spill prevention and control plans' before the start of construction, clearly stating measures to stop the source of the spill, to contain the spill, to dispose the contaminated material and hazardous wastes, and stating designation of personnel trained to prevent and control spills. Hazardous wastes include pesticides, paints, cleaners, and petroleum products.
- 2.28.** The contractor shall ensure that no construction leaches (Ex: cement slurry) is allowed to percolate into the ground. Adequate precautions are to be taken to safeguard against this including reduction of wasteful curing processes, collection, basic filtering and reuse. The contractor shall follow requisite measures for collecting drainage water run-off from construction areas and material storage sites and diverting water flow away from such polluted areas. Temporary drainage channels, perimeter dike/swale, etc. shall be constructed to carry the pollutant-laden water directly to the treatment device or facility (municipal sewer line).
- 2.29.** All lighting installed by the contractor around the site and at the labour quarters during construction shall be CFL/ LED bulbs of the appropriate illumination levels. This condition is a must, unless specifically prescribed otherwise.
- 2.30.** All paints, adhesives and sealants should comply with the VOC limits prescribed by **GRIHA & IGBC, as follows:**

Table 1- VOC limits for paints, adhesives and sealants

Paints	VOC Limit (g/l)	Adhesives	VOC Limit (g/l)
Non-flat paints	150	Wood flooring Adhesive	100
Flat (Mat) paints	50	Tile Adhesive	65
Anti-corrosive/anti-rust	250	Indoor Carpet Adhesive	50
Varnish	350	Wood	30
Lacquer	550	Stains Water proofing sealer	250 250

Table 1B- VOC limits for paints and coatings (prescribed by IGBC)

Type of Paints & Coatings	VOC Limit (g/L less water)
Non-flat (Glossy)	150
Flat (Mat)	50
Anti-corrosive/ Anti-rust	250
Clear Wood Finish: Varnish	350
Clear Wood Finish: Lacquer	550
Floor Coatings	100

Table 1C- VOC limits for adhesives (prescribed by IGBC)

Type of Adhesives	VOC Limit (g/L less water)
Glazing adhesives	100
Ceramic tile adhesives	65
Drywall and panel adhesives	50
Wood substrate adhesives	30
Wood flooring adhesives	100
HVAC duct insulation	850
Indoor Carpet adhesives	50
Multipurpose construction adhesives	70

- 2.31.** All the building materials and systems used on site must be as per the specifications and approved makes by the Engineer-In-Charge.
- 2.32.** All required certificates explaining the properties of the building material/system needs to be obtained from the manufacturer/vendor as required by the green building rating authority. The final certificates would be produced after the approval of green building consultant with necessary due diligence. The purchase orders of all the materials made with the manufacturers / authorized vendors should be maintained and shall be provided for the process with due diligence upon request
- 2.33.** Water saving measures as suggested by the consultants need to be followed on site.
- 2.34.** The contractor / subcontractor shall prepare and submit a Site Management Plan (SMP) within 10 days of start, for approval by the Engineer -in-charge. This SMP shall indicate the locations of godown, stockpiles, barricading, waste storage, offices, vehicular movement routes etc. In short this SMP would comprehensively represent how the site activities shall be managed conforming to GRIHA & IGBC guidelines. Contractor will be penalized @ Rs. 30,000 per day of delay on non- submission of SMP beyond due date to be recovered from next RA bill.
- 2.35.** Any other site management measures suggested by the Engineer-in- charge / green building consultant shall be followed on site.
- 2.36.** The contractor shall submit to the Engineer -in-Charge after construction of the buildings, a detailed as built quantification of the following within 10 days of recording of completion. Contractor will be penalized @ Rs. 30,000 per day of delay on non-submission of SMP beyond due date to be recovered from the Final bill:
- Total materials used
 - Total waste generated,
 - Total waste reused,
 - Total water used,
 - Total electricity consumed, and
 - Total diesel consumed.

- 2.37.** Evidence for the implementation of the all the above required measures shall be provided to the green building consultant in the form of photographs and templates as required which is required for the submission to the green building rating authority (GRIHA & IGBC).
- 2.38.** Building products and materials which have been GreenPro-rated should be given preference while procuring, provided the GreenPro-rated product / material under that category is available.
- 2.39. In compliance to the Hon'ble National Green Tribunal (NGT) and Office Memorandum no. DG/SE/CM/CON/Misc./02 dated 16.03.2016 following preventive /correctivemeasurestobe takenat siteinordertocontrolAirpollutionfrom constructionand demolitionactivity:-**
- i. The contractor shall not store/dump construction material or debris on metalled road.
 - ii. The contractor shall get prior approval from Engineer-in-charge for the area where the construction material or debris can be stored beyond the metalled road. This area shall not cause any obstruction to the free flow of traffic/inconvenience to the pedestrians. It should be ensured by the contractor that no accidents occur on account of such permissible storage.
 - iii. The contractor shall take appropriate protection measures like raising wind breakers of appropriate height on all sides of the plot /area using CGI sheets or plastic and /or other similar material to ensure that no construction material dust fly outside the plot area.
 - iv. The contractor shall ensure that all the trucks or vehicles of any kind which are used for construction purposes/or are carrying construction material like cement, sand and other allied material are fully covered. The contractor shall take every necessary precautions that the vehicles are properly cleaned and dust free to ensure that enroute their destination , the dust, sand or any other particles are not released in air/contaminate air.
 - v. The contractor shall provide mask of every worker working on the construction site and involved in loading, unloading and carriage of construction material and construction debris to prevent inhalation of dust particles.
 - vi. The contractor shall provide all medical help, investigation and treatment to the workers involved in the construction of building and carry of construction material and debris relatable to dust emission.
 - vii. The contractor shall ensure that C&D waste is transported to the C&D Waste site only and due record shall be maintained by the contractor.
 - viii. The contractor shall compulsory use of wet jet in grinding and stone cutting.
 - ix. The contractor shall comply all the preventive and protective environmental steps as stated in the MoEF guidelines, 2010.
 - x. The contractor shall carry out on-Road-Inspection for black smoke generating machinery. The contractor shall use cleaner fuel.
 - xi. The contractor shall ensure that all DG sets comply emission norms notified by MoEF.
 - xii. The contractor shall use vehicles having pollution under control certificate. The emissions can be reduced by a large extent by reducing the speed of a vehicle to 20 kmph. Speed bumps shall be used to ensure speed reduction. In cases where speed reduction cannot effectively reduce fugitive dust, the contractor shall divert traffic to nearby paved areas.
 - xiii. The contractor shall ensure that the construction material is covered by tarpaulin. The contractor shall take all other precaution to ensure that no dust particles are permitted to pollute air quality as a result of such storage.
 - xiv. The paving of the path for plying of vehicles carrying construction material is more permanent solution to dust control and suitable for longer duration projects. The NIT approving authority shall carry out cost benefit ratio analysis of the same.

ADDITIONAL CONDITIONS AND PARTICULAR SPECIFICATIONS FOR CIVIL COMPONENT

3. STRUCTURAL STEEL WORK

- i. This specification covers the fabrication and transportation to site and erection on

- prepared foundations and structural steel work consisting of beams, columns, purlins, vertical trusses, bracings, shear connections etc.
- ii. Fabrication, erection and approval of steel structures shall be in compliance with: General Specifications mentioned in PIU/ Relevant Specification/Relevant Codes/ Relevant Circular/CPWDs and IS : 800 – 1984. For the guidance on general fabrication and erection of structural steel work, Chapter 11 of IS:800 (1984) must be followed. As far as safety is concerned guidance could be obtained from Indian safety code for structural steelwork IS:7205(1974). Before the commencement of the erection, all the erection equipment tools, shackles, ropes etc. should be tested for their load carrying capacity. Such tests if needed may be repeated at intermediate stages also.
- iii. Drawings and supplementary drawings to be supplied to the contractors during execution of the work.
- iv. Providing shop primer coat for steel structures. Grouting of holding- down bolt pockets
- v. and below base plates where required.
- vi. In case of conflict between the Clauses mentioned here and the Indian Standards, those expressed in this specification shall govern.

3.1. Scope

The fabrication and erection of the steel work consists of accomplishing of all jobs here-in enumerated including providing all labour, tools and plant all materials and consumables such as welding electrodes, bolts and nuts, oxygen and acetylene gases, oils for cleaning etc. of approved quality as per relevant IS Code. The work shall be executed according to the drawings, specifications, relevant codes etc. in an expeditious and workman like manner, as detailed in the specifications and the relevant Indian Standard Codes and Standard Practice and to the complete satisfaction of the Engineer-in-charge.

3.2. Fabrication Drawings

- i. The contractor shall prepare all fabrication and erection drawings on the basis of design drawings supplied to him and submit the same in triplicate to the Engineer-in-charge for review, Engineer-in-charge shall review and comment, if any, on the same through consultant. Such review, if any, by the Engineer-in-charge, does not relieve the contractor of any of his required guarantees and responsibilities. The contractor shall however be responsible to fabricate the structural member strictly conforming to specifications and reviewed drawings.
- ii. Fabrication drawings shall include but not limited to the following:
 - a) Member sizes and details
 - b) Types and dimensions of welds and bolts
 - c) Shapes and sizes of edge preparation for welding
 - d) Details of shop and field joints included in assemblies.
- iii. Bill of material
 - a) Quality of structural steels, welding electrodes, bolts, nuts and washers etc. to be used.
 - b) Erection assemblies, identifying all transportable parts and sub-assemblies, associated with special erection instructions, if required.
 - c) Calculations where asked for approval.
- iv. Connections, splices etc. other details not specifically detailed in design drawings shall be suitably given on fabrication drawings considering normal detailing practices and developing full member strengths. Where asked for calculations for the merit shall also be submitted for approval.
- v. Any alternate design or change in section is allowed when approved in writing by the Engineer-in-charge.
- vi. However, if any variation in the scheme is found necessary later, the contractor will be supplied with revised drawings. The contractor shall incorporate these changes in his drawings at no extra cost and resubmit for review.
- vii. Engineer-in-charge review shall not absolve the contractor of his responsibility for the correctness of dimensions, adequacy of details and connections. One copy will be returned reviewed with or without comments to the contractor for necessary action. In the former case further three copies of amended drawings shall be submitted by the contractor for final review.

- viii. The contractor shall supply three prints each of the final reviewed drawings to the Engineer-in-charge within a week since final review, at no extra cost for reference and records.
- ix. The Engineer-in-charge will verify the correct interpretation of their requirements.
- x. If any modification is made in the design drawing during the course of execution of the job, revised design drawings will be issued to the contractor. Further changes arising out of these shall be incorporated by the contractor in the fabrication drawings already prepared at no extra cost and the revised fabrication drawings shall be duly got reviewed as per the above Clauses.

3.3. Materials

- i. Rolled Sections

The following grades of steel shall be used for steel structures: Structural steel will generally be of standard quality conforming to IS:226/IS:2062. Whenever welded construction is specified plates of more than 20mm thickness will generally conform to IS:2062.

 - a) Welding Materials

Welding electrodes shall conform to IS:814.
Approval of welding procedure shall be as per IS:823.
 - b) Bolts, Nuts & Washers

Bolts and nuts shall be as per IS: 1367 and tested as per IS:1608. It shall have a minimum tensile strength of 44Kg/mm² and minimum elongation of 23% on a gauge length of 5.65 (A-Original cross sectional area of the gauge length). Washers shall be as per IS:2016.
- ii. All materials shall conform to their respective specifications. The use of equivalent or higher grade or alternate materials will be considered only in very special cases subject to the approval of the Engineer-in-charge in writing.
- iii. Receipt & Storing of Materials

Steel materials supplied by the contractor must be marked for identification and each lot should be accompanied by manufacturer's quality certificate, conforming chemical analysis and mechanical characteristics.
- iv. All steel parts furnished by supplier shall be checked, sorted out, straightened, and arranged by grades and qualities in stores.
- v. Structural's with surface defects such as pitting, cracks, laminations etc. shall be rejected if the defects exceed the allowable tolerances specified in relevant standards or as directed by the chief Engineer-in-charge.
- vi. Welding wire and electrodes shall be stored separately by qualities and lots inside a dry and enclosed room, in compliance with IS: 816 -1969 and as per instructions given by the Engineer-in-charge.
- vii. Electrodes shall be perfectly dry and drawn from an electrode oven, if required.
- viii. Checking of quality bolts of any kind as well as storage of same shall be made conforming to relevant standards. Each lot of electrodes, bolts, nuts, etc. shall be accompanied by manufacturer's test certificate. The contractor may use alternative materials as compared to design specification only with the written approval of the chief Engineer-in-charge.
- ix. Material Tests

The contractor shall be required to produce manufacturer's quality certificates for the materials supplied by the contractor. Notwithstanding the manufacturer's certificates, the Engineer-in-charge may ask for testing of materials in approved test houses. The test results shall satisfy the requirements of the relevant Indian Standards.
- x. Whenever quality certificates are missing or incomplete or when material quality differs from standard specifications the contractor shall conduct all appropriate tests as directed by the Engineer-in-charge at no extra cost.
- xi. Materials for which test certificates are not available or for which test results do not tally with relevant standard specifications, shall not be used.

3.4. Fabrication

- i. The Contractor will submit the credential with full particulars about work completed by fabricator to be deployed for this work for approval of Engineer-in-charge. After written approval is communicated in respect of fabricator, then only the jobs

should be assigned to him. Fabrication shall be in accordance with IS: 800 Section V in addition to the following:

- ii. Fabrication shall be done as per approved fabrication drawings adhering strictly to work points and work lines on the same. The connections shall be welded or bolted as per design drawings. Work shall also include fabricating built up sections.
- iii. Any defective material used shall be replaced by the contractor at his own expense, care being taken to prevent any damage to the structure during removal.
- iv. All the fabricated and delivered items shall be suitably packed to be protected from any damage during transportation and handling. Any damage caused at any time shall be made good by the Contractor at his own cost.
- v. Any faulty fabrication pointed out at any stage of work shall be made good by the contractor at his own cost.

vi. Preparation of Materials

- a) Prior to release for fabrication, all rolled sections warped beyond allowable limit shall be pressed or rolled straight and freed from twists, taking care that a uniform pressure is applied.
- b) Minor warping, corrugations etc. in rolled sections shall be rectified by cold working.
- c) The sections shall be straightened by hot working where the Engineer-in-charge so directs and shall be cooled slowly after straightening.
- d) Warped members like plates and flats may be used as such only if wave like deformation does not exceed $L/1000$ but limited to 10 mm (L-Length).
- e) Surface of members that are to be jointed by lap or fillet welding or bolting shall be even so that there is no gap between overlapping surfaces.

vii. Marking

Marking of members shall be made on horizontal pads, of an appropriate racks or supports in order to ensure horizontal and straight placement of such members. Marking accuracy shall be at least +1 mm.

viii. Cutting

- a) Members shall be cut mechanically (by saw or shear or by oxyacetylene flame).
- b) All sharp, rough, or broken edges, and all edges of joints which are subjected to tensile or oscillating stresses, shall be ground.
- c) No electric metal arc cutting shall be allowed.
- d) All edges cut by oxyacetylene process shall be cleaned of impurities prior to assembly.
- e) Cutting tolerances shall be as follows:
- f) a) For members connected at both ends + 1 mm.
- g) b) Elsewhere + 3 mm.
- h) The edge preparation for welding of members more than 12 mm thick shall be done by flame cutting and grinding. Cut faces shall not have cracks or be rough.
- i) Edge preparation shall be as per IS:823-1964.

ix. Drilling

- a) Bolt holes shall be drilled.
- b) Drilling shall be made to the diameter specified in drawings.
- c) No enlarging of holes filling, by mandrilling or oxyacetylene flame shall be allowed.
- d) Allowed variations for holes (out-of-roundness, eccentricity, plumb-line deviation) shall be as per IS: 800.
- e) Maximum deviation for spacing of two holes on the same axis shall be +1mm.
- f) Two perpendicular diameters of any oval hole shall not differ by more than 1 mm.
- g) Drilling faults in holes may be rectified by reaming the holes to the next upper diameter, provided that spacing of new hole centres and distance of hole centres to the edges of members are not less than allowed and that the increase of hole diameter does not impair the structural strength. Hole reaming shall be allowed if the number of faulty holes does not exceed 15% of the total number of holes for one joint.

x. Welding:

a) Preparation of Members for Welding

- All welding in mild steel work shall be done with electrodes and / or by methods recommended by the suppliers of the metals being welded in accordance with corresponding Indian Standards. Type, size and spacing of welds, shall be as specified. All welding consumables shall be in accordance with the I.S. standards.
- Welds behind finished mild steel surfaces shall be so done as to eliminate distortion and / or discoloration on the finished side.
- Weld spatter and welding oxides on finished surfaces shall be removed by descaling and / or grinding. Plug, puddle or spot welding shall not be permitted. If weld beads are visible on exposed finished surfaces, the surfaces shall be ground and polished to match and blend with finish on adjacent parent metal.
- Structural welds shall be made by certified welders and shall conform to I.S. code. The welds shall be tested by the Contractor to ensure quality and integrity of the structural welds. However, welding tests shall be carried out as below: and the contractor shall maintain records for Visual testing – 100 % of the welds for size and quality. Fillet weld testing - 100 % of the welds for MPI or Dye penetration test
- Dirt grease, lubricant, or other organic material shall be removed by vapor degreasing or suitable solvent.
- Joints rejected because of welding defects may be repaired only by re welding. Defective welds shall be removed by chipping or machining. Flame cutting shall not be allowed.
- Assembly of structural members shall be made with proper jigs and fixtures to ensure correct positioning of members (angles, axes nodes etc.)
- Sharp edges, rust of cut edges, notches, irregularities and fissures due to faulty cutting shall be chipped or ground or filled over the length of the affected area, deep enough to remove faults completely.
- Edge preparation for welding shall be carefully and accurately made so as to facilitate a good joint.
- Generally no special edge preparation shall be required for members under 8 mm thick.
- Edge preparation (bevelling) denotes cutting of the same so as to result in V, X K or U seam shapes as per IS: 823.
- The members to be assembled shall be clean and dry on the welding edges. Under no circumstances shall wet, greasy, rust or dirt covered parts be assembled. Joints shall be kept free from any foreign matter likely to get in to the gaps between members to be welded.
- Before assembly the edges to be welded as well as adjacent areas extending for atleast 20 mm shall be cleaned (until metallic polish is achieved).
- When assembling members, proper care shall be taken of welding shrinkage and distortions, as the drawing dimensions cover finished dimensions of the structure.
- The elements shall be got checked and approved by the Engineer-in-charge or their authorised representative before assembly.
- The permissible tolerances for assembly of members preparatory to welding shall be as per IS: 823-1964.
- After the assemble has been checked, temporary tack welding in position shall be done by electric welding, keeping in view finished dimensions of the structure.

b) Welding procedures

- Welding shall be carried out only by fully trained and experienced

welders as tested and approved by the Engineer-in-charge. Any test carried out either by the Engineer-in-charge or their representative or the inspectors shall constitute a right by them for such tests and the cost involved thereon shall be borne by the contractor himself.

- Qualification tests for welders as well as tests for approval of electrodes will be carried out as per IS: 823. The nature of test for performance qualification of welders shall be commensurate with the quality of welding required on this job as judged by the Engineer-in-charge.
- The steel structures shall be automatically, semi-automatically or manually welded as per direction of Engineer-in-charge.
- Welding shall begin only after the checks mentioned in Clause herein have been carried out.
- The welder shall mark with his identification mark on each element welded by him.
- When welding is carried out in open air, steps shall be taken to protect the face of welding against wind or rain. The electrodes, wire and parts being welded shall be dry.
- Before beginning the welding operation, each joint shall be checked to ensure that the parts to be welded are clean and root gaps provided as per IS: 823.
- For continuing the welding of seems discontinued due to some reason, the end of the discontinued seem shall be melted in order to obtain a good continuity. Before resuming the welding operation, the groove as well as the adjacent parts shall be well cleaned for a length of approx. 50 mm.
- For single butt welds (in V, 1/2 V or U) and double butt welds (in K, double U etc.) the re-welding of the root is mandatory but only the metal deposit on the root has been cleaned by back gouging or chipping.
- The welding seams shall be left to cool slowly. The contractor shall not be allowed to cool the welds quickly by any other method.
- For multi-layer welding, before welding the following layer, the formerly welded layer shall be cleaned metal bright by light chipping and wire brushing. Backing strips shall not be allowed.
- The order and method of welding shall be so that -
- No unacceptable deformation appears in the welded parts.
- Due margin is provided to compensate for contraction due to welding in order to avoid any high permanent stresses.
- The defects in welds must be rectified according to IS: 823 and as per instruction of Engineer-in-charge.

c) Weld Inspection

- The weld seams shall satisfy the following:
- Shall correspond to design shapes and dimensions.
- Shall not have any defects such as cracks, incomplete penetration and fusion, under-cuts, rough surfaces, burns, blow holes and porosity etc. beyond permissible limits.
- During the welding operation and approval of finished elements, inspections and tests shall be made as per IS code. The mechanical characteristics of the welded joints shall be as in IS: 823.

xi. Bolting

a) Preparation of Members for Bolting

- The members shall be assembled for bolting with proper jigs and fixtures to sustain the assemblies without deformation and bending.
- Before assembly, all sharp edges, shavings, rust dirt, etc. shall be removed.
- Before assembly, the contacting surfaces of the members shall be cleaned and given a coat of primer as per IS: 2074. The members which are bolt assembled shall be set according to drawings and temporarily fastened with erection bolts (minimum 4 pieces) to check the coaxiality of the holes. The members shall be finally bolted after the deviations have been corrected, after which there shall not be gaps.

- Before assembly, the members shall be checked and got approved by the Engineer-in-charge. The difference in thickness of the sections that are butt assembled shall not be more than 3% or maximum 0.8 mm whichever is less. If the difference is larger, it shall be corrected by grinding or filling. Reaming of holes to final diameter or cleaning of these shall be done only after the parts have been check assembled. As each hole is finished to final dimensions (reamed if necessary) it shall be set and bolted up. Erection bolts shall not be removed before other bolts are set.

b) Bolting up

Final bolting of the members shall be done after the defects have been rectified and approval of Engineer-in-Charge obtained. The bolts shall be tightened starting from the centre of joint towards the edge.

c) Planning of Ends

Planning of ends of members like column ends shall be done by grinding when so specified in the design. Planning of butt welded members shall be done after these have been assembled, the spare edge shall be removed with grinding machines or files. The following tolerances shall be permitted on member that have been planned.

On the length of the member having both ends planed, maximum +2mm with respect to design.

Level differences of planed surfaces, maximum 0.3mm.

Deviation between planed surface and member's axis maximum 1/1500.

d) Holes for Field Joints

Holes for field joints shall be drilled in the shop to final diameters and tested in the shop, with trial assemblies. When three-dimensional assembly is not possible in the shop, the holes for field joints may be drilled in shop and reamed on site after erection, on approval by the Engineer-in-charge. For bolted steel structures, trial assembly in shop is mandatory. The tolerance for spacing of holes shall be +1mm.

e) Tolerances

All tolerances regarding dimensions, geometrical shapes and sections of steel structures, shall be as per the detailed specifications and instructions of engineer in charge, if not specified in the drawing.

f) Marking for Identification

All elements and members prior to despatch for erection shall be shop marked. The members shall be visibly marked with a weather proof light coloured paint. The size and thickness of the numbers shall be chosen as to facilitate the identification of members. For the small members that are delivered in bundles or crates, the required marking shall be done on small metal tags securely tied to the bundle, while the crates shall be marked directly. Each bundle or crate shall be packed with members for one and the same assembly; in the same bundle or crate, general utility members such as bolts, nuts etc. may be packed. All bill of materials showing weight, quality and dimension of contents shall be placed in the crates.

The members shall be marked with a durable paint, in a visible location, preferably at one end of the member so that these may be easily checked during storage and erection. All members shall be marked in the shop before inspection and acceptance. When the member is being painted, the marking area shall not be painted but bordered with white paint. The marking and job symbol shall be registered in all shop delivery documents (transportation, for erection etc.)

g) Shop Test Pre-assembly

For steel structures that have the same type of welding the shop test pre-assembly shall be performed on one out of every 10 members minimum. For bolted steel structures, shop test pre-assembly is mandatory for all elements as

well as for the entire structure in conformity with previous Clause.

3.5. Shop Inspection and Approval

i. General

- a) The Engineer-in-charge or their representatives shall have free access at all responsible times to the contractor's fabrication shop and shall be afforded all reasonable facilities for satisfying himself that the fabrication is being undertaken in accordance with drawings and specifications. Technical approval of the steel structure in the shop by the Engineer-in-charge is mandatory.
- b) The contractor shall not limit the number and kinds of tests, final as well as intermediate once, or extra tests required by the Engineer-in-charge. The contractor shall furnish necessary tools, gauges, instrument set etc. and technical non-technical personnel for shop tests by the Engineer-in-charge, free of cost.

ii. Shop Acceptance

- a) The Engineer-in-charge shall inspect and approve at the following stages :
- b) The following approvals may be given in shop:
 - Intermediate approvals of work that cannot be inspected later.
 - Partial approvals
 - Final approvals
- c) Intermediate approval of work shall be given when a part of the work is preformed later:
- d) Cannot be inspected later
- e) Inspection would be difficult to perform and results would not be satisfactory.
- f) Partial approval in the shop is given on members and assemblies of steel structures before the primer coat is applied and includes:
 - Approval of materials
 - Approval of field joints
 - Approval of parts with planed surfaces
 - Test erection
 - Approval of members
 - Approval of markings
 - Inspections and approvals of special features, like Rollers, loading platform mechanism etc.
- g) During the partial approval, intermediate approvals as well as all former approvals, shall be taken in to consideration.

iii. Final approval in the Shop

- a) The final approval refers to all elements and assemblies of the steel structures, with shop primer coat, ready for delivery from shop to be loaded for transportation, or stored.
- b) The final approval comprises of:
 - Partial approvals
 - Approval of shop primer coat
 - Approval of mode of loading and transport
 - Approval of storage (for materials stored)

iv. Painting and Delivery

- a) Preparation of parts for shop painting: Painting shall consist of providing at least one coat of red oxide zinc chromate primer to steel members before despatch from shop. Primer coat shall not be applied unless:
- b) Surface have been wire brushed, cleaned of dust, oil, rust or sand blasted as per the requirement and direction of Engineer-in-charge etc.
- c) Erection gaps between members, spots that cannot be painted or where moisture or other aggressive agents may penetrate, have been filled with an approved type of oil and putty.
- d) The surface to be painted are completely dry.

- e) The parts where water of aggressive agents may collect (during transportation, storage, erection and operation) are filled with putty and provided with holes for drainage of water.
- f) Members and parts have been inspected and accepted
- g) Welds have been accepted.
- h) The following are not to be painted or protected by any other product :
 - Surface which are in the vicinity of joints to be welded at site.
 - Surfaces bearing markings
 - Other surfaces indicated in the design.
- i) The following shall be given a coat of hot oil or any approved resistant lubricant only.
 - Planed surfaces
 - Holes for links
- j) The surfaces that are to be embedded or in contact with the concrete shall be given a coat of cement wash. The surfaces which are in contact with the ground, gravel or brick work and subject to moisture, shall be given bituminous coat. The other surfaces shall be given a primer coating.
- k) Special attention shall be given to locations not easily accessible, where water can collect and which after assembly and erection cannot be inspected, painted and maintained. Holes shall be provided for water drainage and in accessible box type sections shall be hermetically sealed by welds.
- l) If specified elsewhere, in the schedule of quantities, the contractor shall paint further coats of red-oxide after erection and placing in position of the steel structures.
- m) **Packing, transportation, delivery**
 - After final shop acceptance and marking, the item shall be packed and loaded for transportation. Packing must be adequate to protect item against warping during loading and unloading. Proper lifting devices shall be used for loading, in order to protect items against warping. Slender projecting parts shall be braced with additional steel bars, before loading, for protection against warping during transportation. Loading and transportation shall be done in compliance with transportation rules. If certain parts cannot be transported in the lengths stipulated in the design, the position and type of additional splice joints shall be approved by the Engineer-in-charge. Items must be carefully loaded on platforms of transportation means to prevent warping, bending or falling during transportation. The small parts such as fish-plates, quests etc. shall be securely tied with wire to their respective parts. Bolts, nuts and washers shall be packed and transported in crates. The parts shall be delivered in the order stipulated by the Engineer-in-charge and shall be accompanied by document showing:
 - i. Quality and quantity of structure or members
 - ii. Position of member in the structure
 - iii. Particulars of structure
 - iv. Identification number job symbol.

3.6. Field Erection

- i. The erection work shall be permitted only after the foundation or other structure over which the steel work will be erected is approved and is ready for erection.
- ii. The contractor shall satisfy himself about the levels, alignment etc. for the foundations well in advance, before starting the erection. Minor chipping etc. shall be carried out by the contractor on his expense.
- iii. Any faulty erection done by the contractor shall be made good at his own cost.
- iv. Approval by the Engineer-in-charge or their representatives at any stage of work does not relieve the contractor of any of his required guarantees of the contract.
- v. Storage and preparation of parts prior to erection
 - a) The storage place for steel parts shall be prepared in advance and got approved by the Engineer-in-charge before the steel structures start arriving from the shop. A platform shall be provided by the Contractor near the erection site for

- preliminary erection work. The contractor shall make the following verifications upon receipt of material at site.
- b) For quality certificates regarding materials and workmanship according to these general specifications and drawings.
 - c) Whether parts received are complete without defects due to transportation, loading and unloading and defects, if any, are well within the admissible limit.
- vi. For the above work sufficient space must be allotted in the storage area which will be arranged by the contractor without any extra cost to the department. Steps shall be taken to prevent warping of items during unloading. The parts shall be unloaded, stored and stored so as to be easily identified. The parts shall be stored according to construction symbol and markings so that these may be taken out in order of erection. The parts shall be at least 150 mm clear from ground on wooden or steel blocks for protection against direct contact with ground and to permit drainage of water. If rectification of members like straightening etc. are required, these shall be done in a special place allotted which shall be adequately equipped. The parts shall be clean when delivered for erection.
- vii. Erection & Tolerances
- a) Erection in general shall be carried out as required and approved by the Engineer-in-charge.
 - b) Positioning and leveling of the structure, alignment and plumbing of the stanchion and fixing every member of the structure shall be in accordance with the relevant drawings and to the complete satisfaction of the Engineer-in-charge.
- viii. The following checks and inspection shall be carried out before during and after erection.
- a) damage during transportation
 - b) accuracy of alignment of structures
 - c) erection according to drawings and specifications
 - d) progress and workmanship.
- ix. In case there be any deviations regarding positions of foundations or anchor bolts, which would lead to erection deviations, the Engineer-in-charge shall be informed immediately.
- x. Minor rectifications in foundations, orientation of bolts holes etc. shall be carried out as part of the work, at no extra cost. The various parts of the steel structure shall be so erected as to ensure stability against inherent weight, wind and erection stresses.
- xi. The structure shall be anchored and final erection joints completed after plan and elevation positions of the structural members have been verified with corresponding drawings and approved by the Engineer-in-charge. The bolted joints shall be tightened so that the entire surface of the bolt heads and nuts shall rest on the member. For parts with sloping surfaces tapered washers shall be used.

3.7. Final acceptance and handing over the structure

- i. At acceptance, the contractor shall submit the following documents:
- ii. Shop and erection drawings – four sets of soft copy and hard copies, 4 copies of each of the following:
- iii. Shop acceptance documents quality certificate for structurals, plates, etc. (electrodes, welding wire, bolts, nuts, washers etc.)
- iv. List of certified welders who worked on erection of structures.
- v. Acceptance and intermediate control procedure of erection operations.
- vi. Approval by the Engineer-in-charge at any stage of work does not relieve the contractor of any of his required guarantees of the contract.

3.8. Grouting of Pockets

- i. Grouting of pockets and under base plates will be done only after the steel work has been levelled and plumbed and the bases of stranchions are supported by steel shims. The space below the base plate and pockets shall be thoroughly cleaned.
- ii. The mortar used for grouting shall not be leaner than 1:2 (1 cement : 2 sand) (grade 30 in case of concrete) or as is specified and shall be mixed to the minimum consistency required. It shall be poured under suitable head and tamped until the space has been completely filled.

3.9. Tolerances allowed in the erection of building without cranes

The maximum tolerances for line and level of the steel work shall be + 3.00mm on any part of the structure. The structure shall not be out of plumb more than 3.5mm on each 10M. section of height and not more than 7.0 mm per 30M. section. These tolerances shall apply to all parts of the structure unless the drawings issued for erection purposes state otherwise.

3.10. Contractor to submit shop drawing for all structural steel work for approval. The work at site should commence only after getting the shop approved.

3.11. Contractor to get erection scheme approved before commencement of erection of trusses.

4. REINFORCEMENT BARS:

4.1. The Contractor shall procure corrosion resistant TMT bars (Fe500D) from primary producers such as SAIL, Tata Steel Ltd., RINL, Jindal Steel & Power Ltd. and JSW Steel Ltd.

4.2. The specifications of corrosion resistant TMT bars procured from primary producers shall meet the provisions of IS 1786 : 2008 pertaining to Fe 500D grade of steel as specified in the Bid.

4.3. The contractor shall have to obtain and furnish factory test certificates to the Engineer - in-charge in respect of all supplies of steel brought by him to the site of work.

4.4. Samples shall also be taken and got tested by the Engineer -in- Charge as per the provisions in this regard in relevant BIS codes. In case the test results indicate that the steel arranged by the contractor does not conform to the specifications as defined, the same shall stand rejected, and it shall be removed from the site of work by the contractor at his cost within a week time of written orders from the Engineer-in-Charge to do so. Else the department shall remove it and recover double the cost of removal from the contractor.

4.5. The steel reinforcement bars shall be brought to the site in bulk supply of 20 tonnes or more, or as decided by the Engineer -in- charge.

4.6. The steel reinforcement bars shall be stored by the contractor at site of work in such a way as to prevent their distortion and corrosion, and nothing extra shall be paid on this account. Bars of different sizes and lengths shall be stored separately to facilitate easy counting and checking.

4.7. For physical and chemical tests, like checking nominal mass tensile strength, re-bent etc. specimens of sufficient length shall be cut from each size of the bar at random and at frequency not less than that specified below:

Size of Bar	For Consignment below 100 tonnes	For consignments above 100 tonnes
Under 10 mm dia bars	One sample (Three specimen) for each 25 tonnes or part thereof	One sample (Three specimen) for each 40 tonnes or part thereof
10 mm to 16 mm dia bars	One sample (Three specimen) for each 35 tonnes or part thereof	One sample (Three specimen) for each 45 tonnes or part thereof
Over 16 mm dia bars	One sample (Three specimen) for each 45 tonnes or part thereof	One sample (Three specimen) for each 50 tonnes or part thereof

4.8. The contractor shall supply free of charge the steel required for testing including its transportation to testing laboratories. The cost of test shall be borne by the contractor/Department in the manner indicated below:

- By the contractor if the results show that steel does not conform to relevant BIS Codes.
- By the Department if the results show that steel conforms to relevant BIS Codes.

4.9. The actual issue and consumption of steel on work shall be regulated and proper accounts maintained as provided in the contract. The theoretical consumption of steel shall be worked out as per procedure prescribed in clause 4.2 of the contract and shall be governed by the conditions laid therein. In case, the consumption is less than theoretical consumption including permissible variations, recovery at the rates so prescribed shall be made. In case of excess consumption no adjustment shall be made.

4.10. The steel brought to site and the steel remaining unused shall not be removed from site without the written permission of the Engineer-in-charge.

4.11. For the purpose of payment, the actual weight of steel reinforcement, shall be measured as below:

i. Unit weight for reinforcement bars: The actual weight per meter of the reinforcement of various diameters shall be measured for three random samples collected (for each diameter of steel reinforcement) from each lot of particular diameter of steel reinforcement brought to the site for use in the work. For this, each sample (one sample consisting of three specimens) for each diameter of steel reinforcement shall be cut to require lengths and weighed and average weight calculated and recorded. The average weight for each type of steel section and steel reinforcement of each diameter shall be taken as the actual weight per metre for that steel section and that diameter of steel reinforcement.

ii. In case actual unit weight is less than standard unit weights mentioned in PIU/ Relevant Specification/ Relevant Codes/ Relevant Circular/ CPWDs 2009 Volume 1, but within variation, in such cases payment shall be made on the basis of actual unit weight. However, if actual unit weight is more than standard unit weights mentioned in PIU/ Relevant Specification/ Relevant Codes/ Relevant Circular/ CPWDs 2009 Volume 1, then payments shall be made on the basis of standard unit weight in such cases. In such case nothing extra shall be paid for difference in actual weight and standard weight.

4.12. Contractor to submit Bar Bending Schedule (BBS) Drawings as per the structural drawing issued and submit to Engineer-in-Charge in advance for approval. The bar bending schedule shall conform to Indian standard IS 2502- code of practice for Bending and fixing of bars for concrete Reinforcement. Before execution of work, five copies of these drawings each including for revision will be submitted to Engineer-in-Charge for approval, keeping in view the quantum of the work, the BBS shall preferably be prepared with software and one person acquainted with preparing BBS with software shall be deputed at site to speed up the work. One software shall also be installed in the office. The RCC work should commence only after getting the BBS approved and signing of pour card by Engineer-in-charge.

4.13. The decision of the Engineer-in-charge as regards the random samples shall be final and binding on the contractor and no claim of any kind shall be entertained in this regard.

4.14. The work shall be carried out as per the PIU/ Relevant Specification/ Relevant Codes/ Relevant Circular/ CPWDs.

5. CEMENT

5.1. The Contractor shall procure Portland Pozzolana Cement (PPC) conforming to IS 1489 (Part I) with fly ash content as required in the work from reputed manufacturers of cement such as ACC, Ultratech, Dalmia, Konark, Birla, Ambuja & J.K. Cement. Samples of cement arranged by the Contractor shall be taken by the Engineer-in-charge and got tested in accordance with provisions of relevant BIS codes. In case test results indicate that the cement arranged by the Contractor does not conform to the relevant BIS codes, the same shall stand rejected and shall be removed from the site by the Contractor at his own cost within a week's time of written order from the Engineer-in-Charge to do so. The supply of cement shall be taken in 50 Kg bags bearing manufacturer's name and ISI marking.

5.2. The cement shall be brought at site in bulk supply of approximately 50 tonnes or as decided by the Engineer-in-Charge.

- 5.3. Every delivery of cement shall be accompanied by producer's certificate confirming that the supplied cement conforms to relevant specifications. These certificates should be endorsed to Engineer-in-charge for his record.
- 5.4. For each grade, cement bags shall be stored in two separate godowns, one for tested cement and the other for fresh cement (under testing) constructed by the contractor at his own cost as per sketch given in General Conditions of Contract for CPWD 2014 with weather proof roofs and walls. The actual size of godown shall be as per site requirements and as per the direction of the Engineer in charge and nothing extra shall be paid for the same. The decision of the Engineer-in-charge regarding the capacity required/needed will be final. However, the capacity of each godown shall not be less than 250 tonnes or as decided by Engineer-In-Charge.
- 5.5. Each godown shall be provided with a single door with two locks. The keys of one lock shall remain with PIU Engineer-in-charge or his authorized person and that of other lock with the authorized agent of the contractor at the site of work so that the cement is issued from godown according to the daily requirement with the knowledge of both the parties. The account of daily receipt and issue of cement shall be maintained in a register in the prescribed Performa and signed daily by the contractor or his authorized agent in token of its correctness. The contractor shall be responsible for the watch & ward and the safety of the cement godown. The contractor shall facilitate the inspection of the cement godown by the Engineer-in-charge any time.
- 5.6. The cement godown of the capacity to store a minimum of 5000 bags of cement shall be constructed by the Contractor at site of work for which no extra payment shall be made.
- 5.7. The contractor shall supply free of charge the cement required for testing including its transportation cost to testing laboratories. Samples of cement arranged by the contractor shall be taken by the Engineer-in-charge and got tested in accordance with provisions of relevant BIS codes. The cement shall be used on the work only after satisfactory test results have been received. In case the test results indicate that the cement arranged by the contractor does not conform to the relevant BIS codes, the same shall stand rejected, and it shall be removed from the site by the contractor at his own cost within a week's time of written order from the Engineer-in-charge to do so.
- 5.8. The cost of tests shall be borne by the contractor/Department in the manner indicated below:
 - i. By the contractor, if the results show that the cement does not conform to relevant BIS codes.
 - ii. By the Department, if the results show that the cement conforms to relevant BIS codes.
- 5.9. PPC (Portland Pozzolana Cement) shall be used in accordance with the circular issued by the Directorate General of Works vide No.CDO/SE(RR)/Fly Ash (Main)/102 dt.09.04.2009. The use of PPC shall be regulated as per the following conditions stipulated in the circular dt.09.04.2009:-
 - i. IS:456-2000 Code of Practice for Plain and Reinforced Concrete (as amended up to date) shall be followed in regard to Concrete Mix Proportion and its production as under:
 - a) The concrete mix design shall be done as "Design Mix Concrete" as prescribed in clause-9 of IS 456 mentioned above.
 - b) Concrete shall be manufactured in accordance with clause 10 of above mentioned IS:456 covering quality assurance measures both technical and organizational, which shall also necessarily require a qualified Concrete Technologist to be available during manufacture of concrete for certification of quality of concrete.
 - ii. Minimum M25 or as specified grade of concrete shall be used in all structural elements of RCC, both in load bearing and framed structure.
 - iii. The mechanical properties such as modulus of elasticity, tensile strength, creep and shrinkage of concrete using fly ash blended cements (PPCs) are not likely to be significantly different and their values are to be taken same as those used for concrete made with OPC.
 - iv. To control higher rate of carbonation in early ages of concrete in PPC based concrete, water/binder ratio shall be kept as low as possible, which shall be closely monitored during concrete manufacture. If necessitated due to low water/binder ratio, required workability shall be achieved by use of chloride free chemical admixtures conforming to IS:9103. The compatibility of chemical admixtures and super plasticizers with each set PPC received from different sources shall be ensured by trials.
 - v. In environment subjected to aggressive chloride or sulphate attack in particular, PPC

based concrete is recommended. In case, where structural concrete is exposed to excessive magnesium sulphate, fly ash content shall be limited to 18% by weight. Special type of cement with low C3A content may also be alternatively used. Durability criteria like minimum binder content and maximum water/binder ratio also need to be given due consideration in such environment.

- vi. Wet curing period shall be enhanced to a minimum of 10 days or its equivalent. In hot & arid regions, the minimum curing period shall be 14 days or its equivalent.
- vii. Subject to General Guidelines detailed out as above, PPC manufactured conforming to IS:1489 (Part-I) shall be treated at par as per requirement of IS-456 for manufacture of Design Mix Concrete for structural use in RCC.
- viii. Till the time, BIS makes it mandatory to print the %age of fly ash on each bag of cement, the certificate from the PPC manufacturer indicating the same shall be supplied by the contractor.
- ix. While using PPC for structural concrete work, no further admixing of fly ash shall be permitted.

5.10. The actual issue and consumption of cement on work shall be regulated and proper accounts maintained as provided in the contract. The theoretical consumption of cement shall be worked out as per procedure prescribed in clause 42 of the contract and shall be governed by conditions therein. No payment for excess consumption of cement will be allowed. However for consumption lesser than permissible theoretical variation, a recovery shall be made in accordance with conditions of contract of schedule A to F without prejudice to action for acceptance of work/item of reduced rate or rejection, as the case may be.

5.11. For non-schedule items, the decision of the Engineer-in-charge or successor thereof regarding theoretical quantity of cement which should have been actually used shall be final and binding on the contractor.

5.12. Cement brought to site and cement remaining unused after completion of work shall not be removed from site without written permission of the Engineer-in-charge.

5.13. Damaged /settled/expired cement shall be removed from site immediately by the contractor on receipt of notice in writing from the Engineer-in-charge. If he does not do so within three days of receipt of such notice, the Engineer-in-charge shall get it removed at the cost of the contractor.

6. R.C.C. WORK (DESIGN MIX CONCRETE)

6.1. GENERAL:-

- i. The RCC work shall be done with RMC Design Mix Concrete, unless otherwise specified in the nomenclature of items, wherever letter M has been indicated, the same shall imply for the Design Mix Concrete.
- ii. The Ready Mix Concrete shall be as per IS:4926 and as per PIU/ Relevant Specification/Relevant Codes/ Relevant Circular/CPWD and guidelines. For the nominal mix in RCC, PIU/ Relevant Specification/Relevant Codes/ Relevant Circular/CPWD shall be followed.
- iii. The Design Mix Concrete will be designed based on the principles given in IS:456, 10262, SP 23 and PIU/ Relevant Specification/Relevant Codes/ Relevant Circular/CPWDs. The contractor shall carry out design mixes for each class of concrete indicating that the concrete ingredients and proportions will result in concrete mix meeting requirements specified. The cement shall be actually weighed as a presumption of each bag having 50 kg shall not be allowed. In case of use of admixture, the mix shall be designed with these ingredients as well. The specification mentioned herein below shall be followed for Design Mix Concrete.

6.2. INGREDIENTS:-

- i. Coarse Aggregate :- As per PIU/ Relevant Specification/Relevant Codes/ Relevant Circular/CPWDs
- ii. Fine Aggregate :- As per PIU/ Relevant Specification/Relevant Codes/ Relevant Circular/CPWDs.
- iii. Water :- As per requirements laid down in IS 456-2000 and PIU/ Relevant Specification/Relevant Codes/ Relevant Circular/CPWDs.
- iv. Cement: Cement arranged by the contractor will be PPC conforming to IS : 1489 (Part-I) with fly ash content.

- v. Admixture:- Admixtures shall not be used without approval of Engineer-in-Charge. Wherever required, admixtures of approved quality shall be mixed with concrete to achieve the desired workability within specified water cement ratio. The admixture shall conform to IS : 9103. The chloride content in the admixture shall satisfy the requirement of BS : 5075. The total amount of chlorides in the admixture mixed concrete shall also satisfy the requirements of IS : 456-2000
- vi. Minimum and Maximum cement content – shall be accordance as per PIU/ Relevant Specification/Relevant Codes/ Relevant Circular/CPWDs / Items in Bid.

6.3. The contractor shall not be paid anything extra for admixture required for achieving desired workability without any change in specified water cement ratio for RCC / CC work.

6.4. The Concrete mix will be designed for minimum workability as specified in para 7 of IS-456-2000 / monolithic construction.

6.5. The recommended values of slump for various members to confirming to IS 456.

6.6. In the designation of concrete mix letter M refers to the mix and the number to the specified characteristic compressive strength of 15 cm– Cube at 28 days expressed in N/mm². It is specifically highlighted that in addition to above requirement the maximum cement in concrete for any grade shall not exceed 500 kg/cum.

6.7. The concrete design mix with or without admixture will be carried out by the contractor as per direction of Engineer-In-Charge.

6.8. The various ingredients for mix design/laboratory tests shall be sent to the lab / test houses through the Engineer-In-Charge of the project and got it tested in approved laboratories as may be decided by the Engineer-in-charge immediately after award of work and the samples of such aggregate sent shall be preserved at site by the department. The admixture if used by contractor shall be at his own cost without any extra payment.

6.9. The contractor shall submit the mix design report from any of above approved laboratories for approval of Engineer in charge within 30 days from the date of issue of letter of acceptance of the bid. No concreting shall be done until the mix design is approved.

6.10. In case of change of source or characteristic properties of the ingredients used in the concrete mix during the work, a revised laboratory mix design report conducted in laboratories approved by Engineer-In-Charge shall be submitted by the contractor as per the direction of the Engineer in charge.

6.11. APPROVAL OF DESIGNMIX

- i. The mix design for a specified grade of concrete shall be done for a target mean compressive strength $T_{ck} = F_{ck} + 1.65s$
- ii. Where F_{ck} = Characteristic Compressive Strength at 28 days
- iii. s = Standard deviation which depends on degree of quality control.
- iv. The degree of quality control for this work is “good” for which the standard deviation (s) obtained for different grades of concrete shall be as per IS relevant IS Standards/ Codes.
- v. Out of the six specimen of each set, three shall be tested at seven days and remaining three at 28 days. The preliminary tests at seven days are intended only to indicate the strength to be attained at 28 days.

6.12. CHARGESFORDESIGNMIX

All cost of mix designingand testing connectedtherewith includingchargespayabletothelaboratory shallbeborneby the contractor.

6.13. DESIGNMIX CONCRETEFROMFULLYAUTOMATIC COMPUTERISED

CONCRETE BATCHING AND MIXING PLANT

i. Proportioning Concrete

- a) In proportioning cement concrete, the quantity of both cement and aggregates shall be determined by weight. The cement shall be weighed separately from the aggregates. Water shall either be measured by volume in calibrated tanks or weighed.
- b) All measuring equipment shall be maintained in a clean and serviceable condition. The amount of mixing water shall be adjusted to compensate for moisture content in both coarse and fine aggregates. The moisture content of aggregates shall be determined in accordance with IS: 2386 (Part III).
- c) Suitable adjustments shall also be made in the weight of aggregates to allow for the variation in weight of aggregates due to variation in moisture content.

ii. Production of Concrete

- a) The concrete shall be RMC produced in a central batching and mixing plant with computerized printing for contents and admixture dosage. The batching plant shall be fully automatic. Automatic batcher shall be charged by devices which when actuated by a single starter switch will automatically start the weighing operation of each material and stop automatically, when the designated weight of each material has been reached. The batching plant shall have automatic arrangement for dispensing the admixture and shall also be capable of discharging water in more than one stage. A print out from the batching plant for every lot shall be submitted. A batching plant essentially shall consist of the following components :
 - Separate storage bins for different sizes of aggregates, silo for cement; and water storage tank.
 - Batching equipment
 - Mixers
 - Control panels
 - Mechanical material feeding and elevating arrangements
- b) The Contractor shall arrange for inspection of automatic batching plant within seven days of issue of letter of award to facilitate inspection and approval of same by Engineer-In-Charge. Nothing extra will be paid for this.
- c) The compartments of storage bins for aggregates shall be approximately of equal size. The cement compartment shall be centrally located in the batching plant. It shall be watertight and provided with necessary air vent, aeration fittings for proper flow of cement & emergency cement cut off gate. The aggregate and sand shall be charged by power operated centrally revolving chute. The entire plant from mixer floor upward shall be enclosed and insulated. The batch bins shall be constructed so as to be self-cleansing during drawdown. The batch bins shall in general conform to the requirements of IS :4925.
- d) The batching equipment shall be capable of determining and controlling the prescribed amounts of various constituent materials for concrete accurately i.e. water, cement, sand, individual size of coarse aggregates etc. The accuracy of the measuring devices shall fall within the following limits.

Measurement of Cement	±2% of the quantity of cement in each batch
Measurement of Water	±3% of the quantity of water in each batch
Measurement of Aggregate	±3% of the quantity of aggregate in each batch
Measurement of Admixture	±3% of the quantity of admixture in each batch

The batching plant shall consist of locking arrangement for design mix approved with various constituents material qualities.

6.14. Mixing Concrete

- i. The mixer in the batching plant shall be so arranged that mixing action in the mixers can be observed from the operator's station.
- ii. The mixer shall be equipped with a mechanically or electrically operated timing, signaling and metering device which will indicate and assure completion of the required mixing period.

iii. The mixer shall have all other components as specified in IS : 4925.

6.15. Transportation, Placing and Compaction of Concrete

- i. Mixed concrete from the batching plant shall be transported to the point of placement by transit mixers or through concrete pumps or steel closed bottom buckets capable of carrying 6 cum concrete. In case the concrete is proposed to be transported by transit mixer, the mixer speed shall neither be less than 4 rev/ min. of the drum nor greater than a speed resulting in a peripheral velocity of the drum as 70 m / minute at its largest diameter. The agitating speed of the agitator shall neither be less than 2 rev / min. nor more than 6 rev / min. of the drum. The number of revolutions of the mixing drum or blades at mixing speed shall be between 70 to 100 revolutions for a uniform mix, after all ingredients, have been charged into the drum. Unless tempering water is added, all rotation after 100 revolutions shall be at agitating speed of 2 to 6 rev / min. and the number of such rotations shall not exceed 250. The general construction of transit mixer and other requirements shall conform to IS : 5892.
- ii. In case concrete is to be transported by pumping, the electrical conduits shall be primed by pumping a batch of mortar / thick cement slurry through the line to lubricate it. Once the pumping is started, it shall not be interrupted (if at all possible) as concrete standing idle in the line is liable to cause a plug. The operator shall ensure that some concrete is always there in the pump-receiving hopper during operation. The lines shall always be maintained clean and shall be free of dents.
- iii. Materials for pumped concrete shall be batched consistently and uniformly. Maximum size of aggregate shall not exceed one-third of the internal diameter of the pipe. Grading of aggregate shall be continuous and shall have sufficient ultra fine materials (materials finer than 0.25mm). Proportion of fine aggregates passing through 0.25mm shall be between 15 & 30% and that passing through 0.125 mm sieve shall not be less than 5% of the total volume of aggregate. When pumping long distances and through hot weather, set- retarding admixtures may be used. Admixtures to improve workability can be added. Suitability of concrete through pumping shall be verified by trial mixes and by performing pumping tests.

6.16. Preparation Of Cement Concrete as Per Approved Design Mix and Conducting Confirmatory Test At Field Lab.

- i. The contractor shall make the cubes of trial mixes as per approved Mix design at site laboratory for all grades in presence of Engineer- in-charge using sample of approved materials proposed to be used in the work prior to commencement of concreting and get them tested in his presence to his entire satisfaction for 7 days and 28 days. Test cubes shall be taken from trial mixes as follows.
- ii. For each mix, a set of six cubes shall be made from each of the three consecutive batches. Three cubes from each set of six shall be tested at age of 7 days and remaining three cubes at age of 28 days. The cubes shall be made, cured, transported and tested strictly in accordance with the specifications. The average strength of nine cubes at age of 28 days shall exceed the specified target mean strength for which design mix has been approved. The evaluation of test results will be done as per IS:456-2000.

6.17. WORK STRENGTH TEST SPECIMEN

Work strength test shall be conducted in accordance with IS: 516 on random sampling. Each test shall be conducted on six specimens, three of which shall be tested at 7 days and remaining three at 28 days. Additional samples shall be prepared, if required, as per direction of Engineer in charge for testing samples cured by accelerated method as described in IS:9103.

6.18. TEST RESULTS OF SAMPLE

The test results of the sample shall be the average of the strength of three specimens. The individual variation shall not be more than ± 15 percent of the average. If variation is more, the test results of the sample are invalid. 90% of the total tests shall be done at the laboratory established at site by the contractor and remaining 10% in the laboratory of Government Engineering colleges, or in any other

approved laboratory as directed by the Engineer-in-charge.

6.19. STANDARD FOR ACCEPTANCE

- i. Standard of acceptance shall be same as specified in clause 16 of IS 456-2000.
- ii. In order to keep the floor finish as per direction of Engineer-in-charge and as per Architectural drawings and to provide required thickness of the flooring as per specification, the level of top surface of RCC shall be accordingly adjusted at the time of its centering, shuttering and casting for which nothing extra shall be paid to the contractor.

6.20. ULTRASONIC PULSE VELOCITY METHOD OF TEST FOR RCC

- i. The underlying principle of assessing the quality of concrete is that comparatively higher velocities are obtained when the quality of concrete in terms of density, homogeneity and uniformity is good. The consistency of the concrete as regards its general quality gets established. In case of poorer quality, lower velocities are obtained. If there are cracks, voids or flaws inside the concrete which come in the way of transmission of pulse, lower velocities are obtained.
- ii. The quality of concrete in terms of uniformity, incidence or absence of internal flaws, cracks and segregation etc. indicative of the level of workmanship employed, can thus be assessed using the guidance given in table below which have been evolved for characterizing the quality concrete in structure in term of the ultrasonic pulse velocity.

Velocity criterion for Concrete Quality Grading:

Sl. No.	Pulse velocity by Cross Probing (km/sec)	Concrete
1	Above 4.5	Excellent
2	4.5 to 3.5	Good
3	3.5 to 3.0	Medium
4	Below 3.0	Doubtful

Note: In Case of "doubtful" quality, it may be necessary to carry further tests.

- iii. Pulse velocity method of test of concrete is to be conducted for CPWD works as a routine test. The acceptance criteria as per the above table will be applicable which is as per IS 13311 (part-1): 1992. From the above, "Good" and "Excellent" grading are acceptable and below these grading the concrete will not be acceptable.
- iv. 5% of the total number of RCC members in each category i.e. beam, column, slab and footing may be tested by UPV test method for establishing quality of concrete. It is suggested that test be conducted on RCC beam near joint with column, on RCC column near joint with beam, on RCC footings and rafts. On RCC rafts, as suitable grid can be worked out for determining number of tests. In addition, doubtful areas such as honeycombed locations, where continuous seepage is observed, construction joints and visible loose pockets will also be tested.
- v. The test results are to be examined in view of the above acceptance criteria "Good" and "Excellent" and wherever concrete is found with less than required quality as per acceptance criteria, repairs to concrete will be made. Honeycombed areas and loose pockets will be repaired by grouting using Portland Cement Mortar / Polymer Modified Cement Mortar / Epoxy Mortar, etc. after chipping loose concrete in appropriate manner. In areas where concrete is found below acceptance criteria and defects are not apparently visible on surface, injecting approved grout in appropriate proportion using epoxy grout / acrylic Polymer modified cements slurry made with shrinkage compensating cement / plain cement slurry etc will be resorted to for repairs. (refer relevant chapters from CPWD Hand Book on Repairs and Rehabilitation of RCC Buildings). Repair to concrete will be done till satisfactory results are obtained as per the acceptance criteria by retesting of the repaired area. If satisfactory results are not obtained, dismantling and relaying of concrete will be done.

6.21. MEASUREMENT

As per PIU/ Relevant Specification/Relevant Codes/ Relevant Circular/CPWDs.

6.22. TOLERANCES

As per PIU/ Relevant Specification/Relevant Codes/ Relevant Circular/CPWDs

6.23. RATE:-

- i. The rate includes the cost of materials and labour involved in all the operations described above except for the cost of centering, shuttering and reinforcement, which will be paid separately.
- ii. In case of actual average compressive, strength being less than specified strength which shall be governed by para 'Standard of Acceptance' as above, the rate payable shall be worked out accordingly on prorata basis.
- iii. In case of rejection of concrete on account of unacceptable compressive strength, governed by para 'Standard of Acceptance' as above, the work for which samples have failed shall be redone at the cost of contractors. However, the Engineer-in-charge may order for additional tests (like cutting cores, ultrasonic pulse velocity test, load test on structure or part of structure etc) to be carried out at the cost of contractor to ascertain if the portion of structure wherein concrete represented by the sample has been used, can be retained on the basis of results of individual or combination of these tests. The contractor shall take remedial measures necessary to retain the structure as approved by the Engineer in charge without any extra cost. However, for payment, the basis of rate payable to contractor shall be governed by the 28 days cube test results and reduced rates shall be regulated in accordance with para 5.4.13 of Revised PIU/ Relevant Specification/Relevant Codes/ Relevant Circular/CPWD 2009, Vol.-I.
- iv. As per general engineering practice, level of floors in toilet / bath, balconies, shall be kept 12 to 20mm or as required, lower than general floors. Shuttering should be adjusted accordingly. The landing level of mummy / Staircase cabin shall be kept one riser level higher than adjoining slab level so as to accommodate water proofing treatment over terrace slab. In case of kitchen slab the portion of floor trap below kitchen platform be kept at lower level as per drawings. Nothing extra is payable on this account.
- v. For the execution of centering and shuttering, the contractor shall use propriety "Reebol" chemical mould release agent of FOSROC or equivalent as shuttering oil as approved by Engineer-in-charge and nothing extra shall be paid on this account.

6.24. READY MIX CONCRETE (RMC)/BATCH MIX CONCRETE FROM RMC PRODUCER

- i. Contractor shall install batch mix plant at site immediately after the work is awarded.
- ii. The contractor shall, within a period of 10 days of award of the work, submit text of MOU proposed to be entered between purchaser (the contractor) and supplier (RMC) producer) to the Engineer-in-Charge for his approval. The contractor shall draw the MOU with approved RMC producer and submit to the Engineer-in-Charge within a week of such approval. The contractor will not be allowed to use ready mix concrete without completion of above stated formalities.
- iii. Notwithstanding the approval granted by the Engineer-in-Charge in aforesaid manner or provisions in PIU/ Relevant Specification/Relevant Codes/ Relevant Circular/CPWDs 2009, the contractor shall be fully responsible for quality of concrete including input control, transportation and placement etc.
- iv. For all purpose the contractor shall carry out fully, the responsibilities of the placement contractor and the manufacturer of concrete.
- v. The Engineer-in-Charge will reserve right to inspect at any stage and reject the concrete if he is not satisfied about quality of product at the user's end.
- vi. The Engineer-in-Charge reserves the right to exercise control over the:-
 - a) Ingredients water and admixtures purchased stored and to be used in the concrete including conducting of tests for checking quality of materials recording of test result and declaring the materials fit or unfit for use in production of mix.
 - b) Calibration check of the RMC plant.
 - c) Weight and quantity check on the ingredients, water and admixture added for batch mixing.

- d) Time of mixing of concrete.
- e) Testing of fresh concrete, recording of results and declaring the mix fit or unfit for use. This will include continuous control on the workability during production and taking corrective action, if required.
- f) For exercising such control, the Engineer-in-Charge shall periodically depute his authorized representative at the RMC plant. It shall be responsibility of the contractor to ensure that all necessary equipment, manpower & facilities are made available to the Engineer-in-Charge and/or his authorized representative at RMC plant.
- vii. The contractor should therefore draw MOU/agreement with RMC producer very carefully keeping in view all terms and conditions/specifications forming part of this document.
- viii. All required relevant records of RMC shall be made available to the Engineer-in-Charge or his authorized representative. The Engineer-in-Charge shall as required, specify guidelines & additional procedures for quality control & other parameters in respect of materials, production & transportation of concrete mix which shall be binding on the contractor & the RMC plant. Only concrete as approved in design mix by the Engineer-in-Charge shall be produced in RMC plant and transported to the site.
- ix. PPC/Conforming to IS: 1489 (part-I) of brand/make/source as approved by the Engineer-in-Charge shall only be used for production of RMC. RMC mix with PPC Cement.

6.25. QUALITY CONTROL OF READY MIXED CONCRETE

- i. It shall be the responsibility of the contractor to ensure that RMC producer provides all necessary testing equipments and takes all necessary measures to ensure quality control of ready mixed concrete. In general the required measures shall be:-
- ii. Control of purchased material quality
RMC producer shall ensure that all the materials purchased and used in the production of concrete conform to the stipulation of the relevant agreed standards and the requirements of the concrete mix design and quality control procedures. This shall be accomplished by visual checks, sampling and testing, certification from material supplier and information/date from materials supplier. Necessary equipment for the testing of all materials shall be provided and maintained in calibrated condition at the plant by the RMC producer.
- iii. Control of material storage
Adequate and effective storage arrangement shall be provided by RMC producer at RMC plant for reliable transfer and feed systems, drainage of aggregate, prevention of freezing or excessive solar heating of aggregate, prevention from contamination etc.
- iv. Record of mix design and mix design modification
RMC producer shall ensure that record of mix design and mix design modification is readily available in his computer at RMC plant for inspection of Engineer-in-Charge or his authorized representative at any time. Any modification in mix design shall be done only after the approval of the Engineer-in-Charge.
- v. Transfer and weighing equipment
RMC producer shall ensure that a documented calibration procedure is in place. Proper calibration records shall be made available indicating date of next calibration due & corrective action taken.
RMC producer shall ensure additional calibration checks whenever required by the Engineer-in-Charge in writing to contractor. RMC producer shall also maintain a daily production record including details of customers to whom RMC was supplied including details of mixes supplied. Record shall also be maintained of materials used for each day's production including water and admixtures.
The accuracy of measuring equipment shall be within + 2% of quantity of cement & + 3% of quantity of aggregate, admixture and water being measured.
- vi. Maintenance of Plant, Truck Mixers and Pumps:
Plant, Truck Mixers and Pumps should be well maintained so as to not hamper any operation of production, transportation and placement of concrete.
- vii. Production of concrete at RMC producing plant
 - a) Weighing (correct reading of batch date and accurate weighing):- For each load, written, printed or graphical records shall be made of the weights of the materials batched, the estimate slumps, the total amount of water added to the load, the delivery ticket numbers for that load and the time of loading the

concrete into the truck.

- b) Visual observation of concrete during production and delivery or during sampling and testing of fresh concrete (assessment of uniformity cohesion, workability, adjustment to water content:- The workability of the concrete shall be controlled on a continuous basis during production. The batch mix found unfit shall not be loaded into the truck for transportation. Necessary corrective action shall be taken in the production of mix as required for further batches.
- c) Adequate testing equipments at the plant including equipment for measuring surface moisture content of aggregates shall be provided by the RMC producer.
- d) Making corresponding adjustments at the plant automatically or manually to batched quantities to allow for observed measured or reported changes in materials or concrete qualities.
- e) Sampling of concrete, testing, monitoring of results.
- f) Diagnosis and correction of faults identified from observation/complaints.
- g) Control of designed and the prescribed mixes: a quality control system shall be operated to control the strength of designed mixes to the required levels. The system shall include continuous analysis of results from cube tests.

viii. Ready mix concrete shall be arranged in quantity as required at site of work. The ready mix concrete shall be supplied as per the pre-agreed schedule approved by Engineer-in-Charge. Nothing extra shall be payable on this account.

ix. The Engineer-in-Charge reserves the right to approve RMC producing plants not mentioned in the list of approved RMC plants if they fulfill all the necessary conditions.

x. In case of rejection of concrete as governed by the para "Standard of Acceptance" as above, the work for which samples have failed shall be redone at the cost of the contractor. However, the Engineer-in-Charge may order for additional tests (like cutting cores, ultrasonic pulse velocity, and rebound hammer test etc.) to be carried out at the cost of contractor to ascertain, if the portion of structure wherein concrete represented by the sample has been used, can be retained on the basis of results of individual or combination of these tests. The contractor shall take remedial measures necessary to retain the structure as approved by the Engineer-in-Charge without any extra cost. However, for payment, the basis of rate payable to contractor shall be governed by the 28 days cube test result and reduced rates shall be regulated in accordance with para 5.4.10.5 D(D-3) of PIU/ Relevant Specification/ Relevant Codes/ Relevant Circular/ CPWDs.

6.26. Laying of RMC concrete- All ready mixed designed concrete shall be laid with the help of concrete pump of adequate capacity.

6.27. TRANSPORTATION, PLACING AND COMPACTION OF CONCRETE

i. Mixed concrete from the RMC shall be transported to the point of placement by transit mixers and placed in position through concrete pumps and/or steel closed bottom buckets capable of carrying minimum 0.6 cum concrete is proposed to be transported by transit mixer, the mixing speed shall not be less than 4 rev/min. of the drum nor greater than a speed resulting in a peripheral velocity of the drum 70 m/minutes at its largest diameter. The agitating speed for the agitator shall be not less than 2 rev/min nor more than 6 rev/min of the drum. The numbers of revolution for a uniform mix, after all ingredients, have been charged into the drum. Unless tempering water is added, all rotation after 100 revolutions shall be at agitating speed of 2 to 6 rev/min and the number of such rotations shall not exceed 250. The general construction of transit mixer and other requirement shall conform to IS: 5892.

ii. In case concrete is to be transported by pumping, the conduit shall be primed by pumping a batch of mortar through the line to lubricate it. Once the pumping is started, it shall not be interrupted (if at all possible) as concrete standing idle in the line is liable to cause a plug. The operator shall ensure that some concrete is always there in the pump receiving hopper during operation. The lines shall always be maintained clean and shall be free of dents.

- iii. At all stages, special precaution shall be taken that surrounding temperature during concreting shall not exceed 30 degree centigrade.
- iv. Except where otherwise agreed to by the Engineer-in-Charge, concrete shall be deposited in horizontal layers to a compacted depth of not more than 450mm. unless agreed to by the Engineer-in-charge; concrete shall not be dropped into place from a height exceeding 1.5m. In order to avoid such situations chutes, termite pipe or closed bottom buckets shall be used. These shall be kept clean and used in such a way as to avoid segregation. Slope of the chute shall be so adjusted that concrete flows without the use of excessive quantity of water. The delivery end of 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. The concrete shall be compacted by using immersion type vibrators. When the concrete is being continuously deposited to a uniform depth along a member, vibrator shall not be operated within one meter of free end of the advancing concrete. Every effort shall be made to keep the surface of the previously placed layer of concrete alive so that the succeeding layer can be amalgamated with it by the vibration process.
- v. In case the concrete in underlying layer has hardened to such an extent that it cannot be penetrated by the vibrator but is still fresh (that is, just after initial set), un-imposed bond shall be achieved between the top and underlying layer by first scarifying the lower layer before the new concrete is placed by systematically and thoroughly vibrating the new concrete. The points of insertion of vibrator in the concrete shall be so spaced that the range of action overlap to some extent and the freshly filled concrete is sufficiently consolidated at all locations. The spacing between the dipping positions of vibrator shall be maintained uniformly throughout the surface of concrete so that concrete is uniformly vibrated. The vibrating head shall be regularly and uniformly inserted in the concrete so that it penetrates of its own accord and shall be withdrawn slowly whilst running so as to allow redistribution of concrete in its way and allow the concrete to flow back into the hole behind the vibratory.
- vi. The vibrator head shall be kept in one position till the concrete within its influence is completely consolidated. Vibration shall be continued until the coarse aggregate particles have blended into the surface but have disappeared. The contractor shall keep at least one additional vibrator in serviceable condition to be used in the event of breakdowns and maintenance problems.
- vii. The vibrator head shall not be brought more than 200mm near to the formwork as this may cause formation of water stagnations. The formwork shall be strong and great care shall be exercised in its assembly. It shall be designed to take up increased pressure of concrete and pressure variations caused in the neighborhood of vibrating head, which may result in excessive local stress on the formwork. The joints of the formwork shall be made and maintained tight and close enough to prevent the squeezing out slurry or sucking in of air during vibration. The formwork to receive concrete shall be cleaned and made free from standing water, dust, etc. The contractor shall keep provision for screed and shutter vibrators at site.

6.28. COVER/SPACER BLOCK

The contractor shall provide approved type of support for maintaining the bars in position and ensuring required spacing and correct cover of concrete to reinforcement as called for in the drawings. Chairs and spacer bars shall be used in order to ensure accurate positioning of reinforcement. Spacer blocks shall be cast well in advance with approved proprietary pre-packed free flowing mortars (Conbextra as manufactured by M/S Fosroc Chemicals India Ltd. or equivalent as approved by the Engineer-in-charge at his discretion) of high early strength and same colour as surrounding concrete. Pre-cast cement mortar/concrete blocks/blocks of polymer shall not be used as spacer blocks unless specially approved by the Engineer-in-charge, rate of RCC items is inclusive of cost of such cover blocks.

7. BASIS AND METHODOLOGY FOR DRIVEN CAST IN SITU CONCRETE PILES.

The nature of soil is loose sand with high water table. In such type of soils erosion due to sea currents, liquefaction due to high water table in poorly graded sand may happen, hence deep pile foundation is a suitable foundation system in such type of soil.

Cast-in-situ piles shall be installed by driving a metal casing with a shoe at the tip and displacing the material laterally. Driven cast-in-situ pile is formed by driving a

casing, permanent or temporary and subsequently filling the hole with plain or reinforced concrete.

Following methodology shall be adopted for Driven cast in situ piles:

7.1. Procedure of Pile Driving

- (i) Driven cast-in- situ concrete piles are installed by driving a metal casing with a shoe at the tip/toe and displacing the material laterally.
- (ii) These piles may be cast in metal shells which may remain permanently in place or the casing may be withdrawn which may be termed as uncased driven cast-in-situ cement concrete piles.
- (iii) The metal casing shall be of sufficient thickness and strength to hold in original form and show no harmful distortion when the adjacent casing is driven and the driving core if any is withdrawn.
- (iv) Driven cast-in-situ concrete piles shall be installed using a properly designed detachable shoe at the bottom of the casing.
- (v) Any liner or borehole; which is temporarily located and shows partial collapse that would affect the load carrying capacity of the pile, shall be rejected or repaired as directed by the Engineer-in-Charge.

A proper record of pile driving and other details such as depth driven, sequence of installation in a group, cut off level/working level shall be mentioned in sequence of occurrence worksheet for the inspection of Engineer-in-charge.

7.1. Jetting

- i) Driving of pile may be assisted by pre boring holes or by the use of jets or both subject to the approval of the Engineer-in-charge. These may be used essentially to achieve the minimum penetration shown on the drawings where such penetration is not reached under normal conditions of driving. The diameter of the hole shall; not be greater than the diagonal dimension of the pile less 100mm.
- ii) The maximum depth of the pre-boring shall be such that the specified set (or less) is obtained when the toe of the pile is at founding level. Pre-boring shall be as approved by the Engineer-in-charge and shall not extend beyond one meter above the founding level and the pile shall be driven to at least one meter below the prebored hole. To ensure that the pile is properly supported laterally in the hole, any space remaining around the pile at the ground level after driving is finished shall be backfilled with approved granular material.
- iii) When the water jetting is used at least two jets shall be attached to the pile symmetrically. The volume and pressure of water at the outlet nozzles shall be sufficient to freely erode material adjacent to the toe of the pile. The maximum depth of jetting shall be such that the specified set is obtained when the toe of the pile is at founding level. Jetting shall cease as directed by the Engineer-in-Charge and shall not proceed beyond one meter above the founding level and the pile shall be driven at least one meter below the pre-bored hole.
- iv) To avoid very hard driving and vibration in materials such as sand, jetting of piles by means of water may be carried out in such a manner as not to impair the bearing capacity of piles already in place, the stability of the soil or the safety of any adjoining buildings. Details of arrangement for jetting shall be got approved from the Engineer-in-Charge in advance.
- v) If large quantities of water are used for jetting it may be necessary to make provision for collection of water when it comes to the ground surface so that the stability of the piling plant is not endangered by the softening of the ground. Jetting shall be stopped before completing the driving which shall always be finished by ordinary methods. Jetting shall be stopped if there is any tendency for the pile tips to be drawn towards the pile already driven owing to the disturbance to the ground.

7.2. Reinforcement

- i. The design of reinforcing cage varies depending upon the driving and installation conditions, the nature of the sub-soil and the nature of load to be transmitted by the shaft, axial or otherwise. The minimum area of longitudinal reinforcement of any type or grade within the pile shaft shall be 0.4 percent of the sectional area calculated on the basis of the outside area of the casings of the shaft.
- ii. The curtailment of reinforcement along the depth of the pile, in general, depends on the type of loading and sub-soil strata. In case of piles subjected to compressive load only, the designed quantity of reinforcement may be curtailed at appropriate level according to design requirements. For piles subjected to uplift load, lateral load & moments, separately or with compressive loads, it may be necessary to

provide reinforcement to the full depth of the pile. In soft clays or loose sands, or where there is likelihood of danger to green concrete due to driving of adjacent piles, the reinforcement should be provided up to full pile depth, regardless of whether or not it is required from uplift & lateral load considerations. However, in all cases, the minimum reinforcement specified in above Para (i) above should be provided in full length of the pile.

- iii. Stiffener rings preferably of 16 mm diameter at every 1.5 m centre-to-centre should be provided along length of the cage for providing rigidity to reinforcement cage. Minimum 6 numbers of vertical bars shall be used for a circular pile and minimum diameter of vertical bar shall be 12 mm. The clear horizontal spacing between the adjacent vertical bars shall be four times the maximum aggregate size in concrete. If required, the bars can be bundled to maintain such spacing.
- iv. Piles shall always be reinforced with a minimum amount of reinforcement as dowels keeping the minimum bond length in to the pile shaft below its cut-off level, and with adequate projection in to the pile cap, irrespective of design requirements.
- v. Note: In some cases the cage may lift at bottom or at the laps during withdrawal of casing. This can be minimized by making the reinforcement "U" shaped at the bottom and up to well secured joints. Also the lifting 5 percent of the length should be considered not to affect the quality of pile.
- vi. Clear cover to all main reinforcement in pile shaft shall be not less than 50 mm and shall be maintained by suitable spacers. The laterals of reinforcing cage may be in the form of links or spirals. The diameter and spacing of the same is chosen to impart adequate rigidity of the reinforcing cage during the handling and installation. The minimum diameter of links or spirals shall be 8mm and the spacing of the links or spirals shall be not less than 150mm. The minimum clear distance between two adjacent main reinforcement should normally be 100 mm for full depth of the cage.
- vii. The reinforcing cage should be left with adequate protruding length above the cut off level for proper embedment in the pile cap. Prior to the lowering of reinforcement cage in to the pile shaft, the shaft shall be cleaned of all loose materials.
- viii. Reinforcement in the form of cage shall be assembled with additional support, such as spreader forks and lacings; necessary to form a rigid cage hoops, links, or helical reinforcement has to fit closely around the main longitudinal bars and shall be tied by binding wire of approved quality. The ends of the binding wire shall be turned in to the interior of the pile. Reinforcement shall be placed and maintained in correct position. The reinforcements shall be joined wherever necessary by welding and the procedure of welding be followed as described in IS 2751.

7.3. Concrete

Cement:	Cement shall be as specified in agreement item or as specified under sub-head 3.0 of PIU/ Relevant Specification/Relevant Codes/ Relevant Circular/CPWDs. However, high alumina cement shall not be used.
Water:	Water to be used for concreting shall be as specified under sub head 3.0 of PIU/ Relevant Specification/Relevant Codes/ Relevant Circular/CPWDs.
Fine Aggregate:	Fine aggregate to be used for concreting shall be as specified under sub-head 3.0 of PIU/ Relevant Specification/Relevant Codes/ Relevant Circular/CPWDs.
Coarse Aggregate:	For tremie concreting, coarse aggregate having nominal size more than 20 mm should not be used. Natural rounded shingle of appropriate size may also be used as coarse aggregate. It helps to give high slump with less water cement ratio.

Chemical Admixtures: Admixtures to be used in the concrete shall be as per IS 9103.

7.4. Concrete Grades to be adopted:-

- (i) Concreting of piles shall be done only with design mix of appropriate grade with weigh batching of constituents. The grade of concrete to be kept as per nomenclature of the item.
- (ii) Concrete Grade M-25 and /or higher grades shall be used for concreting the piles. The exact grade of concrete to be used shall mainly depend upon the nature of work and the general design consideration. However, Concrete Grade

M-15 and Grade M-20 shall not be used for concreting piles under any circumstances, even with weigh batching.

- (iii) When concreting underwater or drilling mud, 10 percent additional cement over the minimum cement content for the particular grade shall be used.

7.5. Workability of Concrete:

The minimum slump shall be 100 mm when the concrete for the piles is being vibrated and when the concrete is not vibrated the maximum permitted slump is 150 mm. The degree of workability in both the cases is considered as very high.

7.6. Placing of Concrete:

- i) Before commencement of pouring of concrete, it shall be ensured that there is no ingress of water in the casing tubes from bottom. Further, adequate control during withdrawal of the casing tube is essential so as to maintain sufficient head of concrete inside the casing tube at all stages of withdrawal.
- ii) Wherever practicable concrete should be placed in a clean dry hole where concrete is placed in dry hole and when casing is present, the top 3m pile shall be compacted using internal vibrators. The concrete should in variably be poured through a tremie, with a funnel so that the flow is directed and concrete can be deposited in the hole without segregation. Care shall be taken during concreting to prevent as far as possible the segregation of the ingredients. The displacement or distortion of reinforcement during concreting and also while extracting the tube shall be avoided.
- iii) Where the casing is withdrawn from cohesive soils for the formation of cast-in-situ pile, the concreting should be done with necessary precautions to minimize the softening of the soil by excess water. Where mud flow conditions exist, the casing of cast-in-situ piles shall not be allowed to be withdrawn.
- iv) The concrete shall be self compacting and shall not get mixed with soil, excess water, or other extraneous matter. Special care shall be taken in silt clays and other soils with tendency to squeeze in to newly deposited concrete and cause necking. Sufficient head of green concrete shall be maintained to prevent inflow of soil or water in to concrete. The placing of concrete shall be continuous process from the toe level to the top of pile to prevent segregation, a tube of Tremie pipe as appropriate shall be used to place concrete in all piles. To ensure compaction by hydraulic static heads, rate of placing concrete in the pile shaft shall not be less than 6m (length of pile) per hour.
- v) The diameter of the finished pile shall not be less than specified and a continuous record shall be kept by the Engineer as to the volume of concrete placed in relation to the length of pile cast. After each pile has been cast and any empty pile hole remaining shall be protected and backfilled as soon as possible with approved material.
- vi) The minimum embedment of cast-in-situ concrete piles in to pile cap shall be 150 mm. Any defective concrete at the head of the completed pile shall be cut away and made good with new concrete. The clear cover between the bottom reinforcement in pile cap from top of pile shall not be less than 30mm. The reinforcement in the pile shall be exposed for full anchorage length to permit it to be adequately bonded in to the pile cap. Exposing such length shall be done carefully to avoid damaging the rest of the pile. In cases where the pile cap is to be laid on ground a leveling course with cement concrete of Grade M-15 and of 100 mm thickness shall be provided.
- vii) Normally concreting of piles should be uninterrupted. In exceptional case of interruption of concreting, but which can be resumed within 1 or 2 hours, the tremie shall not be taken out of the concrete. Instead it shall be raised and lowered slowly from time to time to prevent the concrete around the pipe from setting. Concreting should be resumed by introducing a little richer concrete with a slump of about 200 mm for each displacement of the partly set concrete. If the concreting cannot be resumed before final set of concrete already laid, the pile so cast may be rejected.
- viii) In case of withdrawal of tremie out of concrete, either accidentally or to removed a choke in the tremie, the tremie may be re-introduced to prevent impregnation of laitance scum lying on the top of the concrete already deposited

in the bore. The tremie shall be gently lowered on to the old concrete with very little penetration initially. A vermiculite plug should be introduced in the tremie. Fresh concrete of slump between 150mm and 175mm should be filled in the tremie which will push the plug forward and will emerge out of the tremie displacing the laitance/scum. The tremie will be pushed further in steps masking fresh concrete sweep away laitance scum in its way. When the tremie is buried by about 60 to 100 cms, concreting may be resumed.

- ix) The top of concrete in a pile shall be brought above the cut-off level to permit removal of all laitance and weak concrete before capping and to ensure good concrete at the cut-off level for proper embedment in to the pile cap.
- x) Where cut-off level is less than 1.5 metres below the working level concrete shall be cast to a minimum of 300mm above cut-off level. For each additional 0.3 m increase in cut-off level below the working level additional coverage of 50 mm minimum shall be allowed. Higher allowance may be necessary depending on the length of the pile. When concrete is placed by tremie method concrete shall be cast to the piling platform level to permit over flow of concrete for visual inspection or to a minimum of one meter above cut off level. In the circumstances where cut-off level is below ground water level the need to maintain pressure on the unset concrete equal to or greater than water pressure should be observed and accordingly length of extra concrete above cut-off level shall be determined.

7.7. Placing Concrete under Water

- i) Before concreting under water, the bottom of the hole shall be cleared of drilling mud and all soft loose materials very carefully. In case a hole is bored with use of drilling mud, concreting should not be taken up when the specific gravity of bottom slurry is more than 1.2. The drilling mud should be maintained at 1.5m above the ground water level. Concreting underwater for cast-in-situ concrete piles may be done either with the use of tremie method or by the use of approved method specially designed to permit under water placement of concrete. General requirements and precautions for concreting underwater are as follows:
- ii) The concreting of pile must be completed in one continuous operation. Also for bored holes, the finishing of the bore, cleaning of the bore, lowering of reinforcement cage and concreting of pile for full length must be accomplished in one continuous operation without any stoppage.
- iii) The concrete should be coherent, rich in cement with high slump & restricted water cement ratio.
- iv) The tremie pipe will have to be large enough with due regard to the size of the aggregate. For 30mm aggregate the tremie pipe should be of diameter not less than 150 mm and for larger aggregate, larger diameter of tremie pipe may be necessary.
- v) The first charge of concrete should be placed with a sliding plug pushed down the tube ahead of it to prevent mixing of water and concrete.
- vi) The tremie pipe should always penetrate well in to the concrete with an adequate margin of safety against accidental withdrawal if the pipe is surged to discharge the concrete.
- vii) The pile should be concentrated wholly by tremie and the method of deposition should not be changed part way up the pile to prevent the laitance from being entrapped within the pile.
- viii) All tremie tubes should be scrupulously cleaned after use.
- ix) When concreting is carried out underwater a temporary casing should be installed to the full depth of the borehole or 2m in to non collapsible stratum, so that fragments of ground cannot drop from the sides of the hole in to the concrete as it is placed. The temporary casing may not be required except near the top when concreting under drilling mud.



Fig.1: showing boring of cast in situ piles.

Design Considerations

7.8. General

Pile foundations shall be designed in such a way that the load from the structure can be transmitted to the sub-surface with adequate factor of safety against shear failure of sub-surface and without causing such settlement (differential or total), which may result in structural damage and/or functional distress under permanent/transient loading. The pile shaft should have adequate structural capacity to withstand all loads (vertical, axial or otherwise) and moments which are to be transmitted to the subsoil and shall be designed according to IS 456.

7.9. Adjacent Structures

- i) When working near existing structures care shall be taken to avoid damage to such structures. IS 2974 (Part 1) may be used as a guide for studying qualitatively the effect of vibration on persons and structures.
- ii) In case of deep excavations adjacent to piles, proper shoring or other suitable arrangement shall be made to guard against undesired lateral movement of soil.

7.10. Pile Capacity

i) The load-carrying capacity of a pile depends on the properties of the soil in which it is embedded. Axial load from a pile is normally transmitted to the soil through skin friction along the shaft and end-bearing at its tip. A horizontal load on a vertical pile is transmitted to the soil primarily by horizontal subgrade reaction generated in the upper part of the shaft. Lateral load capacity of a single pile depends on the soil reaction developed and the structural capacity of the shaft under bending. It would be essential to investigate the lateral load capacity of the pile using appropriate values of horizontal sub-grade modulus of the soil.

ii) The ultimate load capacity of a pile should be estimated by means of static formula based on soil test results. Pile capacity should preferably be confirmed by initial load tests [see IS 2911 (Part 4)]. The settlement of pile obtained at safe load/working load from load-test results on a single pile shall not be directly used for estimating the settlement of a structure. The settlement may be determined on the basis of subsoil data and loading details of the structure as a Whole using the principles of soil mechanics.

iii) Vertical load capacity (using static formula)

The ultimate load capacity of a single pile may be obtained by using static analysis, the accuracy being dependent on the reliability of the soil properties for various strata. When computing capacity by static formula, the shear strength parameters obtained from a limited number of borehole data and laboratory tests should be supplemented, wherever possible, by in-situ shear strength obtained from field tests. The two separate static formula are commonly applicable for cohesive and non-cohesive soil. Other formula based on static cone penetration test [see IS 4968 (Parts 1, 2 and 3)] and standard penetration test (see IS 2131) are also available to assess the capacity.

iv) Uplift Capacity

The uplift capacity of a pile is given by sum of the frictional resistance and the weight of the pile (Buoyant or total as relevant). The recommended factor of safety is 3.0 in the absence of any pullout test results and 2.0 with pullout test results. Uplift capacity can be obtained from static formula by ignoring end-bearing but adding weight of the pile (buoyant or total as relevant).

v) Negative Skin Friction or Drag down Force

When a soil stratum, through which a pile shaft has penetrated into an underlying hard stratum, compresses as a result of either it being unconsolidated or it being under a newly placed fill or as a result of remoulding during installation of the pile, a drag down force is generated along the pile shaft up to a point in depth where the surrounding soil does not move downward relative to the pile shaft. Existence of such a phenomenon shall be assessed and suitable correction shall be made to the allowable load where appropriate.

vi) Structural Capacity

The piles shall have necessary structural strength to transmit the loads imposed on it, ultimately to the soil. In case of uplift, the structural capacity of the pile, that is, under tension should also be considered.

vii) Axial Capacity

Where a pile is wholly embedded in the soil (having an undrained shear strength not less than 0.01 N/mm^2), its axial load carrying capacity is not necessarily limited by its strength as a long column. Where piles are installed through very weak soils (having an undrained shear strength less than 0.01 N/mm^2), special considerations shall be made to determine whether the shaft would behave as a long column or not. If necessary, suitable reductions shall be made for its structural strength following the normal structural principles covering the buckling phenomenon. When the finished pile projects above ground level and is not secured against buckling by adequate bracing, the effective length will be governed by the fixity imposed on it by the structure it supports and by the nature of the soil into which it is installed. The depth below the ground surface to the lower point of contra flexure varies with the type of the soil. In good soil the lower point of contra flexure may be taken at a depth of 1 m below ground surface subject to a minimum of 3 times the

diameter of the shaft. In weak soil (undrained shear strength less than 0.01 N/mm²), such as, soft clay or soft silt, this point may be taken at about half the depth of penetration into such stratum but not more than 3 m or 10 times the diameter of the shaft whichever is more. The degree of fixity of the position and inclination of the pile top and the restraints provided by any bracing shall be estimated following accepted structural principles. The permissible stress shall be reduced in accordance with similar provision for reinforced concrete columns as laid down in IS 456.

viii) Lateral Load Capacity

A pile may be subjected to lateral force for a number of causes, such as, wind, earthquake, water current, earth pressure, effect of moving vehicles or ships, plant and equipment, etc. The lateral load capacity of a single pile depends not only on the horizontal sub grade modulus of the surrounding soil but also on the structural strength of the pile shaft against bending, consequent upon application of a lateral load. While considering lateral load on piles, effect of other co-existent loads, including the axial load on the pile, should be taken into consideration for checking the structural capacity of the shaft. A recommended method for the pile analysis under lateral load is available in relevant code. Because of limited information on horizontal sub grade modulus of soil, and pending refinements in the theoretical analysis, it is suggested that the adequacy of a design should be checked by an actual field load test. In the zone of soil susceptible to liquefaction the lateral resistance of the soil shall not be considered.

ix) Fixed and free head conditions

A group of three or more pile connected by a rigid pile cap shall be considered to have fixed head condition. Caps for single piles must be interconnected by grade beams in two directions and for twin piles by grade beams in a line transverse to the common axis of the pair so that the pile head is fixed. In all other conditions the pile shall be taken as free headed.

7.11. Raker Piles

Raker piles are normally provided where vertical piles cannot resist the applied horizontal forces.

Generally the rake will be limited to 1 horizontal to 6 vertical. In the preliminary design, the load on a raker pile is generally considered to be axial. The distribution of load between raker and vertical piles in a group may be determined by graphical or analytical methods. Where necessary, due consideration should be made for secondary bending induced as a result of the pile cap movement, particularly when the cap is rigid. Free-standing raker piles are subjected to bending moments due to their own weight or external forces from other causes. Raker piles, embedded in fill or consolidating deposits, may become laterally loaded owing to the settlement of the surrounding soil. In consolidating clay, special precautions, like provision of permanent casing, should be taken for raker piles.

7.12. Spacing of Piles

The minimum centre-to-centre spacing of piles is considered from three aspects, namely,

- a) practical aspects of installing the piles,
- b) Diameter of the pile, and
- c) Nature of the load transfer to the soil and possible reduction in the load capacity of piles group.

NOTE - In the case of piles of non-circular cross-section, diameter of the circumscribing circle shall be adopted

- i. In case of piles founded on hard stratum and deriving their capacity mainly from end-bearing the minimum spacing shall be 2.5 times the diameter of the circumscribing circle corresponding to the cross-section of the pile shaft. In case of piles resting on rock, the spacing of two times the said diameter may be adopted.
- ii. Piles deriving their load-carrying capacity mainly from friction shall be spaced sufficiently apart to ensure that the zones of soils from which the piles derive their support do not overlap to such an extent that their bearing values are reduced. Generally the spacing in such cases shall not be

less than 3 times the diameter of the shaft.

7.13. Pile Groups

- i. In order to determine the load-carrying capacity of a group of piles a number of efficiency equations are in use. However, it is difficult to establish the accuracy of these efficiency equations as the behaviour of pile group is dependent on many complex factors. It is desirable to consider each case separately on its own merits.
- ii. The load-carrying capacity of a pile group may be equal to or less than the load-carrying capacity of individual piles multiplied by the number of piles in the group. The former holds true in case of friction piles, cast into progressively stiffer materials or in end-bearing piles.
- iii. In case of piles deriving their support mainly from friction and connected by a rigid pile cap, the group may be visualized as a block with the piles embedded within the soil. The ultimate load capacity of the group may then be obtained by considering block failure taking into account the frictional capacity along the perimeter of the block and end-bearing at the bottom of the block using the accepted principles of soil mechanics.
- iv. When the cap of the pile group is cast directly on reasonably firm stratum which supports the piles, it may contribute to the load-carrying capacity of the group. This additional capacity along with the individual capacity of the piles multiplied by the number of piles in the group shall not be more than the capacity..
- v. When a pile group is subjected to moment either from superstructure or as a consequence of inaccuracies of installation, the adequacy of the pile group in resisting the applied moment should be checked. In case of a single pile subjected to moment due to lateral loads or eccentric loading, beams may be provided to restrain the pile effectively from Lateral or rotational movement.
- vi. In case of a structure supported on single piles/ group of piles resulting in large variation in the number of piles from column-to-column it may result in large differential settlement. Such differential settlement should be either catered for in the structural design or it may be suitably reduced by judicious choice of variations in the actual pile loading. For example, a single pile cap may be loaded to a level higher than that of the pile in a group in order to achieve reduced differential settlement between two adjacent pile caps supported on a number of piles.

7.14. Factor of Safety

- i. Factor of safety should be chosen after considering,
 - a) The reliability of the calculated value of ultimate load capacity of a pile,
 - b) The types of superstructure and the type of loading, and
 - c) Allowable total/differential settlement of the structure.
- ii. When the ultimate load capacity is determined from static formula, the factor of safety would depend on the reliability of the formula and the reliability of the subsoil parameters used in the computation. The minimum factor of safety on static formula shall be 2.5. The final selection of a factor of safety shall take into consideration the load settlement characteristics of the structure as a whole at a given site.
- iii. Higher value of factor of safety for determining the safe load on piles may be adopted, where,
 - a) Settlement is to be limited or unequal settlement avoided,
 - b) Large impact or vibrating loads are expected, and
 - c) The properties of the soil may deteriorate with time.

7.15. Transient Loading

The maximum permissible increase over the safe load of a pile, as arising out of wind loading, is 25 percent. In case of loads and moments arising out of earthquake effects, the increase of safe load on a single pile may be limited to the provisions contained in IS 1893 (Part 1). For transient loading arising out of superimposed loads, no increase is allowed.

7.16. Overloading

When a pile in a group, designed for a certain safe load is found, during or after execution, to fall just short of the load required to be carried by it, an overload up to 10 percent of the pile capacity may be allowed on each pile. The total overloading on the group should not, however, be more than 10 percent of the capacity of the group subject to the increase of the load on any pile being not more than 25 percent of the allowable load on a single pile.

7.17. Design of Pile Cap

- i. The pile caps may be designed by assuming that the load from column is dispersed at 45° from the top of the cap to the mid-depth of the pile cap from the base of the column or pedestal. The reaction from piles may also be taken to be distributed at 45° from the edge of the pile, up to the mid-depth of the pile cap. On this basis the maximum bending moment and shear forces should be worked out at critical sections. The method of analysis and allowable stresses should be in accordance with IS 456.
- ii. Pile cap shall be deep enough to allow for necessary anchorage of the column and pile reinforcement.
- iii. The pile cap should be rigid enough so that the imposed load could be distributed on the piles in a group equitably.
- iv. In case of a large cap, where differential settlement may occur between piles under the same cap, due consideration for the consequential moment should be given.
- v. The clear overhang of the pile cap beyond the outermost pile in the group shall be a minimum of 150 mm.
- vi. The cap is generally cast over a 75 mm thick levelling course of concrete. The clear cover for main reinforcement in the cap slab shall not be less than 60 mm.
- vii. The embedment of pile into cap should be 75 mm.
- viii. The design of grade beam if used shall be as given in IS 2911 (Part 3).

7.18. MATERIALS AND STRESSES

Cement

The cement used shall be Portland pozzolana cement (fly ash based) conforming to IS 1489 (Part 1),

Steel

Reinforcement steel shall be Corrosion resistant TMT bars (Fe 500D).

Concrete

- i) Consistency of concrete to be used for bored cast *in-situ* piles shall be consistent with the Method of installation of piles. Concrete shall be so designed or chosen as to have a homogeneous mix having a slump/workability consistent with the method of concreting under the given conditions of pile installation.
- ii) The slump should be 150 to 180 mm at the time of pouring.
- iii) The minimum grade of concrete to be used for bored piling shall be M 25. For sub Aqueous concrete, the requirements specified in IS 456 shall be followed. The minimum cement content shall be 400 kg/m³. However, with proper mix design and use of proper admixture the cement content may be reduced but in no case the cement content shall be less than 350 kg/m³.
- iv) For the concrete, water and aggregates specifications laid down in IS 456 shall be followed in general.
- v) The average compressive stress under working load should not exceed 25 percent of the specified works cube strength at 28 days calculated on the total cross-sectional area of the pile.
 - a. Where the casing of the pile is permanent, of adequate thickness and of suitable shape, the
 - b. allowable compressive stress may be increased.
- vi) Drilling Mud (Bentonite)
The drilling mud (Bentonite) to be used for stabilizing the borehole in bored piling work.

7.19. WORKMANSHIP

Control of Piling Installation

- i) Bored cast in-situ piles should be installed by installation technique, covering,
 - a) The manner of borehole stabilization, that is, use of casing and/or use of drilling mud;
 - b) manner of concreting which shall be by use of tremie; and
 - c) choice of boring tools in order to permit satisfactory installation of a pile at a given site. Detailed information about the subsoil conditions is essential to determine the installation technique.
- ii) **Control of Alignment**

Piles shall be installed as accurately as possible according to the design and drawings either Vertically or to the specified batter. Greater care should be exercised in respect of installation of single piles or piles in two-pile groups. As a guide, an angular deviation of 1.5 percent in alignment for vertical piles and a deviation of 4 percent for raker piles should not be exceeded. Piles should not deviate more than 75 mm or $D/6$ whichever is less (75 mm or $D/10$ whichever is more in case of piles having diameter more than 600 mm) from their designed positions at the working level. In the case of single pile under a column the positional deviation should not be more than 50 mm or $D/6$ whichever is less (10 mm in case of piles having diameter more than 600 mm). Greater tolerance may be prescribed for piles cast over water and for raking piles. For piles to be cut-off at a substantial depth below the working level, the design shall provide for the worst combination of the above tolerances in position and inclination. In case of piles deviating beyond these limits and to such an extent that the resulting eccentricity cannot be taken care of by redesign of the pile cap or pile ties, the piles shall be replaced or supplemented by additional piles. In case of piles, with non-circular cross-section 'D' should be taken as the dimensions of pile, along which the deviation is computed. In such cases the permissible deviation in each direction should be different depending upon the dimension of the pile along that direction.
- iii) A minimum length of two meters of temporary casing shall be provided for each bored pile. Additional length of temporary casing may be used depending on the condition of the strata, ground water level, etc.
- iv) In sub surfaces comprising of loose fill, soft marine clay, presence of aggressive ground water, tidal effect or in adverse subsoil conditions like loose bouldary zones/voids, etc, and in marine condition, piles may be formed using permanent liner up to the firm strata.

7.20. Use of Drilling Mud

- i) In case a borehole is stabilized by use of drilling mud, the specific gravity of the mud suspension should be determined at regular intervals by a suitable slurry sampler. Consistency of the drilling mud shall be controlled throughout the boring as well as concreting operations in order to keep the hole stabilized as well as to avoid concrete getting mixed up with the thicker suspension of the mud.
- ii) The concreting operations should not be taken up when the specific gravity of bottom slurry is more than 1.12. The slurry should be maintained at 1.5 m above the ground water level.

7.21. Cleaning of Borehole

- i) If a borehole is stabilized by drilling mud, the bottom of the hole shall be cleaned of all loose and undesirable materials before commencement of concreting in the following manner:
 - a) Boring done with normal bailor and chisel with temporary/permanent liner - First heavier material to be removed with cleaning tools, such as, bailor and then reinforcement cage and tremie pipe to be lowered. Flushing then to be continued with water/drilling fluid under pressure through tremie pipe.
 - b) Boring done with bentonite slurry - Procedure given in (a) above to be followed. However, flushing shall be done with fresh bentonite slurry.
 - c) Boring done by rotary drilling rigs -Cleaning bucket attached to the kelly shall be used for cleaning the bore. Wherever bentonite slurry is used, after using cleaning bucket, the bore shall be flushed with fresh bentonite slurry.

In case of flushing with water or bentonite slurry, the pump capacity shall be suitably decided depending on depth and diameter of bore so that sufficient pressure is built to lift the material up along with the fluid. Flushing should be continued till coarse materials cease to come out with the overflowing fluid. The finer materials will

normally remain suspended in the fluid but they do not pose any problem. Alternatively, air lift technique may be used for cleaning of bore hole, if required.

7.22. Tremix Concreting

- i) Concreting for bored piles shall be done by tremie method. The following requirements are particularly to be followed for tremie concrete work:
 - a) The concrete should be coherent, rich in cement (not less than 400 kg/m³) and of slump between 150-180 mm.
 - b) The tremie should be water-tight throughout its length and have a hopper attached to its head by a water-tight connection.
 - c) The tremie pipe should be large enough in relation to the size of the aggregate. For 25mm down aggregate, the tremie pipe should have a diameter not less than 200 mm. For 20 mm down aggregate, tremie pipe should be of diameter not less than 150 mm. All piling above 600 mm diameter piles, should, however preferably be done with 200 mm diameter tremie pipe;
 - d) A steel plate or a ball is placed at the bottom of the hopper and the hopper is filled with concrete. The first charge of concrete is sent down the tremie by removal of this plate or ball. Additional concrete is then added into the hopper and by surging action is pushed down the tremie and into the pile bore to the bottom of the pile. Theoretically, a small part of the first charge which gets contaminated is supposed to be the top of the rising concrete within the bore;
 - e) The tremie pipe should always be kept full of concrete and should always remain at least one meter into the concrete in the bore hole with adequate margin against accidental withdrawal of tremie pipes;
 - f) The pile should be concreted wholly by tremie and the method of deposition should not be changed midway to prevent laitance from being entrapped within the pile;
 - g) All tremie pipes should be cleaned before and after use; and
 - h) A sliding plug of polystyrene or similar material lighter than water and approved by the Engineer-in-charge or his representative shall be placed in the tremie pipe to prevent direct contact between the first charge of concrete in the tremie and the bentonite slurry.
- ii) Normally concreting of the piles should be uninterrupted. In exceptional cases of interruption of concreting, it shall be resumed within 1 or 2 h, but the tremie shall not be taken out of the concrete. Instead it shall be raised and lowered from time-to-time to prevent the concrete around the tremie from setting.
- iii) In case of withdrawal of tremie out of the concrete, either accidentally or to remove a choke in the tremie, the tremie may be introduced 60 cm to 100 cm in the old concrete and concreting resumed as mentioned in 4.4.1. The fresh concrete will emerge out of the tremie displacing the laitance and scum and prevent impregnation or laitance of scum in the fresh concrete.
- iv) The top of concrete in a pile shall be brought above the cut-off level to permit removal of all laitance and weak concrete before capping and to ensure good concrete at the cut-off level. The reinforcing cages shall be left with adequate protruding length above cut-off level for proper embedment into the pile cap.
- v) Where cut-off level is less than 2.5 m below the ground level, concrete shall be cast to a minimum of 600 mm above cut-off level. For each additional 0.3 m increase in cut-off level below the working level, additional coverage of minimum 50 mm shall be allowed. Higher allowance may be necessary depending on the length of the pile. When concrete is placed by tremie method, concrete shall be cast up to the ground level to permit overflow of concrete for visual inspection or to a minimum of one meter above cut-off level. In the circumstances where cut-off level is below ground water level, the need to maintain a pressure on the unset concrete equal to or greater than water pressure should be observed and accordingly length of extra concrete above cut-off level shall be determined.

7.23. Defective Pile

- i) In case, defective piles are formed, they shall be left in place. Additional piles as necessary shall be provided.
- ii) Any deviation from the designed location, alignment or load capacity of a pile shall be noted and adequate measures taken well before the concreting of the pile cap and plinth beams.

- iii) While removing excess concrete or laitance above the cut-off level chipping by manual or pneumatic tools shall be permitted seven days after pile casting. Before, chipping/breaking the pile top, a 40 mm deep groove shall be made manually all round the pile at the required cut-off level.
- iv) After concreting the actual quantity of concrete shall be compared with the average obtained from observations made in the case of a few piles already cast. If the actual quantity is found to be considerably less, the matter should be investigated and appropriate measures taken.

7.24. Recording of Data

- i) A daily site record shall be maintained for the installation of piles and shall essentially contain the following information:
 - a) Sequence of installation of piles in a group;
 - b) Number and dimension of the pile, including the reinforcement details and mark of the pile;
 - c) Depth bored (including depth in soft/hard rock);
 - d) Time taken for boring, concreting and empty boring, chiseling and whether the pile is wet or dry;
 - e) Cut-off level/ working level;
 - f) Sample bore log in the initial stage or when major variation occur;
 - g) When drilling mud is used, specific gravity of the fresh supply and contaminated mud in the bore hole before concreting shall be recorded regularly; and
 - h) Any other important observation.

8. SPECIAL CONDITIONS AND SPECIFICATIONS FOR MONOLITHIC CONCRETE STRUCTURE.

- i) Aluminium form work should be designed and customised as requirement of architectural/ structural/service drawings.
- ii) Contractors must order sufficient quantity and cement slurry tight aluminium form work, its accessories, hardware and related item to complete the project in time.
- iii) A mock up of aluminium form work shall be examined by the Architect/Engineer in charge at the factory location.
- iv) It is advisable to order extra accessories and hardware to avoid one site delays.
- v) Lubricants for the form work must be applied as per manufacturer guidelines.
- vi) De-shuttering and stocking for form work must be done as per manufacturer guidelines.
- vii) Manufacturer of aluminium form work will provide minimum supervisors/ shuttering experts to execute the work under supervision, provide training and assistant to workers for entire period of RCC casting. The supervisors will provide training to workers in regard of erection of shuttering, conduiting, plumbing, casting of RCC, de shuttering, stacking of de shuttering materials, oiling and lubricating etc..
- viii) Since the finishing of concrete has the biggest role in the final finished product, it is mandatory to achieve the finish up to the satisfaction of the Architect/Engineer in charge.
- ix) A temporary sample unit with complete finishing items should be using approved material to be pre-deciding layout /location of electrical, sanitary and water supply appliances, switches and sockets. The unit should be furnished complete in all respect with doors and windows including fittings, painting, hardware, flooring etc. Nothing extra shall be paid for the sample unit and same shall be refinished at the time of completion of project.
- x) Aluminium form work should handled carefully by trained labourers of manufacturer or contractor.
- xi) For core cutting/ sealing of joint with approved material (non shrink grout) for taking out of sanitary/ water supply/ fire fighting cables, pipes etc. if any nothing extra shall be paid.
- xii) Manufacturer of aluminium from work will submit certificate in every months through contractor to Engineer-in-Charge ensuring the form work is fit for achieving good quality concrete work in all respect. Agency has to removed defective aluminium form work from site promptly.

9. POST- TENSIONING WORK IN SLABS/BEAMS

9.1. GENERAL:

- i) **SpecializedAgency**

The contractor shall be required to engage a specialized agency for post tensioning work from the list of approved agencies given in the Bid document or as approved by Engineer-in-charge. The qualified and approved representatives of the specialized agency shall have to be available at site during operations relating to the post tensioning work. Nothing extra shall be paid on this ground.

ii) Scope of work

Post- tensioning work shall comprise of the following which may be paid separately or collectively as per the description of the item of work or as specified in relevant paras.

- a) Performing all engineering required to fully design a post-tensioning system that complies with the final force and tendon profiles as shown on the structural drawings and to prepare complete shop drawings and field placing drawings. Design and drawings prepared by the contractor through specialized agency shall be approved by the proof consultant appointed by the Department. Necessary fee of proof consultant shall be paid by the specialized agency. However, specialized agency may be required to be present during discussion with proof consultant and modify the drawings as recommendations of proof consultant. Nothing extra shall be paid in this regard. Final design shall be approved by the Engineer-in Charge in consultation with structural consultant and proof consultant.
- b) Performing all post-tensioning operations including stressing, anchoring, trimming, encapsulating tendon anchors, and grouting including all materials required for the same.
- c) Recording and reporting tendon elongation and tension applied to the prestressing steel. Locking of strands (seating of wedges) after stressing shall be made by hydraulic pressure system.
- d) Concreting of patches left out for Post- tensioning.
- e) Mark the tendon layout in red on the formwork in order to have the marking in the soffit slab for the information where the tendon after the concrete.

9.2. The duties of the post-tensioning agency shall also include:

- i) Checking tendon placement before and during pouring of concrete. Be present during pours and checking for tendons being moved out of position.
- ii) Observing that tendon elongation measurements are made and recorded & after stressing submitting copy of same to Engineer.
- iii) Checking of tendon force and/or elongation if requested by the Engineer.

9.3. SUBMITTALS

- iv) Tendon layout, including dimensions, which locates the tendons in the horizontal plane. Detail horizontal curvature of tendons at block-outs, openings and anchorages, and show all openings in slabs and beams. Clearly designate each tendon.
- v) Size of tendon profiles showing support heights and locations, and any required reinforcing support steel. Show clearly the location of each tendon and the method of support. Coordinate the location of post-tension anchorages to eliminate conflicts with other embedded items such as curtain wall anchorages, or other similar type anchorages.
- vi) Value of the wobble and curvature coefficients and anchorage set used in the design to calculate the tendon elongation.
- vii) Details of reinforcement around stressing pockets, closures and openings, including bursting reinforcement, and any interference with tendons. Coordinate with mild reinforcing steel drawings as required.
- viii) Details of anchorages, the positive connection between the anchorage and sheathing, pocket formers, couplers, and other related hardware.
- ix) Details of the method for sealing the anchorage recesses after the tendon stressing tails have been removed.
- x) Clearance requirements for the hydraulic equipment and the dimensions of any stressing pockets required.
- xi) Sequence of construction, including installation, pouring, jacking procedure, and stressing sequences. Show all construction joints and related tendon details.
- xii) Samples of forms to be used for field record of stressing operations.
- xiii) Thickness of post-tensioning sheathing.
- xiv) Shop drawings shall be signed and sealed by a qualified professional engineer.
- xv) Submit calculations showing all engineering required to fully design the posttensioning system, including friction loss calculations, bursting reinforcement calculations, number

of pre-stressing tendons, anchorage and coupling systems, tendon supports, and tendon stressing procedures, as required to fully comply with the final force and tendon profiles as shown on the structural drawings. The design shall be in accordance with the requirements of IS: 1343 or ACI 318. Submit tendon manufacturer's data that documents the wobble and curvature friction coefficients used in the friction loss calculations. Clearly show on the shop drawings the values of wobble and curvature coefficients used in the design.

xvi) Stressing Records: The contractor shall provide the appropriate record, and clearly report the following information.

- a) Floor, pour and tendon identification numbers. For walls, indicate wall location. Calculated elongation and actual measured elongation for each jacking point, and totals for each tendon.
- b) Stressing Jack number, initial and final gauge load reading during stressing for each tendon.
- c) Date of stressing operation and signature of the Contractor's stressing personnel and inspector witnessing the operation.
- d) Range of allowable elongations for jacking force or a measure of the deviation of the measured elongations from the calculated elongations.
- e) Obvious irregularities or stress loss during anchoring procedures.

9.4. MANUFACTURER'S DATA: SUBMIT FOR REVIEW AND APPROVAL

- i) Sample hardware, including but not limited to: Anchorage system, strand, wedges, pocket formers, and other sub-assemblies required for complete installation including all accessories required to complete the system.
- ii) Post-tensioning system brochures.
- iii) Complete post-tensioning procedure, including but not limited to: Stressing system, method of determining anchor force, method of determining tendon slack, and method of cutting off excess strand after anchorage.
- iv) Mill Certificates: Submit certified mill reports of post-tensioning steel immediately upon shipment indicating compliance with specified requirements for all material that is to be delivered to the project.
- v) Equipment Calibration: Submit certification of the Jack efficiency certificate & pressure gauges calibration certificates to engineer in-charge prior to stressing operation.
- vi) Certifications and other data as may be further required to demonstrate compliance with other items in this section.

9.5. MATERIALS

- i) Cement - The cement used shall be PPC conforming to IS: 1489 (Part-I) of the following, with the prior approval of the engineer-in-charge:
- ii) Water, fine and coarse aggregate, admixtures and Reinforced Cement Concrete Work required for Concreting in patches shall be as specified under respective clauses of relevant chapters of relevant Reinforced Cement Concrete Work of PIU/ Relevant Specification/Relevant Codes/ Relevant Circular/CPWDs 2009 as applicable.
- iii) Pre - stressing steel
 - a) Strand: Pre-stressing steel shall be Uncoated stress relieved Low- Relaxation strands Type conforming to IS14268:1995 or relevant standard.
 - b) All pre-stressing steel shall be free from splits, harmful scratches. Surface flaws; rough, jagged and imperfect edges and other defects likely to impair its use in pre-stressed concrete. Slight rust may be permitted provided there is no surface pitting visible to the naked eye.
 - c) Coupling units and other similar fixtures used in conjunction with the wires or, bars shall have an ultimate tensile strength of not less than the individual strengths of the wires or bars being joined.
- iv) Identification: All pre-stressing steel within every group or in the same member shall be of the same heat where practical. All tendons shall be assigned a proper heat and coil number and so identified on fabrication lists that are to be sent to the field with each shipment.

9.6. SAMPLING AND CRITERIA FOR CONFORMITY

- i) Selection of Test Samples

Test samples of sufficient length to permit the tests for breaking load, 0.2 percent proof load and elongation shall be cut from one end of a coil selected at random from a group of every 5

numbers of coils.

- a) The test piece shall not be detached from the coil or length of strand, except in the presence of purchaser or his authorised representative.
- b) Before test pieces are selected, the manufacturer or supplier shall furnish the purchaser or his authorised representative with copies of the mill records giving number of coils in each cast with sizes as well as the identification marks, whereby each coil can be identified.

9.7. Criteria for Conformity

- i) Should any sample fail any of the tests, by agreement between the manufacturer and the purchaser, two additional test samples from the same end of the same coil shall be taken and subjected to the test or tests in which the original sample failed. Should both additional samples pass the test or tests, the coil from which they were taken shall be deemed to comply with the requirements of this standard. Should either of them fail, the coil shall be deemed not to comply.
- ii) Should 10 percent or more of the selected coils fail to fulfil the requirement of this standard, the parcel from which they were taken shall be deemed not to comply with this standard.

9.8. Sheathing: All post-tensioning tendons shall be enveloped with corrugated HDPE/Galvanized steel sheathing according to approved system/specification for post-tensioning in slabs.

9.9. Tendon Support System

- i) Slab Tendons: Support points shall consist of a bar support and continuous steel as shown on the Contract Drawings. Bar supports shall be plastic, plastic tipped, epoxy coated or stainless steel.
- ii) Beam Tendons: Supports shall consist of reinforcing steel tied between stirrup legs as shown on the Contract Drawings.

9.10. GROUT VENTS

Grout vents of at least 20 mm diameter shall be provided at both ends of the sheathing and at all high points of tendon profile as mentioned /specified in the shop drawings. Additional vents with plugs shall also be provided along the length of sheathing such that the spacing of consecutive vents does not exceed 20 m. Each of the grout vents shall be provided with a valve/plug or similar device capable of withstanding a pressure of 1.0 MPa without the loss of water, air pressure or grout.

9.11. Un-tensioned Steel

Reinforcement used as un-tensioned steel for anti-spalling and anti-bursting shall be Thermo-mechanically treated (TMT) 500D Grade of primary producers only. Other Specifications of Un-tensioned reinforcement steel shall be as per Para 5.1.3 of chapter 5.0 of PIU/ Relevant Specification/Relevant Codes/ Relevant Circular/CPWDs (Vol. 1) 2009.

9.12. Stacking and Storage pre-stressing and Un-tensioned steel

- i) 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 colours.
- ii) 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.
- iii) 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.
- iv) 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.
- v) 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.

9.13. HANDLING & INSTALLATION OF STRANDS

The strands are inserted or placed into the ducts, provided in the concrete structures. Placement / Insertion of the strands can be done either prior to concreting or after the concreting as well, but the insertion before the concreting is more dependable and therefore, should be given more preference. In this case, the ducts/sheathings must be

tied firmly to the tendon supports or reinforcement bars. When the strands are inserted after concreting, necessary precaution should be taken to prevent the sheathing duct, from getting clogged with cement slurry during concreting. The most commonly used method is to insert a dummy pipe or mandrel inside the duct and regularly agitate it during concreting procedure. This prevents any settlement of cement slurry in the duct.

9.14. NECESSARY PRECAUTIONS – FOR INSTALLING DUCTS & STRANDS

- i) Fix the Sheathing duct firmly on the smaller end of the Guide or trumpet.
- ii) Test Certificate of the Pre-stressing Steel and Identification Label from the Strand Coil should be kept in safe custody. These data sets are very important and shall be used for Calculating the modified force and elongation at the time of carrying out stressing operation. Strand data from the “Identification label” and Tendon number, in which the strand has been used, should be recorded in the Construction Book.
- iii) Strand should be uncoiled in such a manner that it does not get twisted and should not be laid or dragged on soiled or rough surfaces. A wooden palate should ideally be erected in the yard for dragging & laying the strands after de-coiling.
- iv) Strand should not be laid or dragged on soiled or rough surfaces. A wooden palate should ideally be erected in the yard for dragging & laying the strands after de-coiling.
- v) Strands should be cut evenly by an abrasive cutter in desired length.
- vi) Strands ends should be ground smooth, to prevent any damage to the duct during insertion by pushing. If required a suitable bullet end can also be employed to have a smooth insertion.
- vii) When the strands are pulled into the tendon ducts together in bundle, special care should be taken to prevent the damage to the duct or the strands. Roller cradles can be used to carry the tendons on the rough ground.
- viii) In case of threading of strands after concreting, it is recommended to use a De-Coiler and the Strand Pushing Machine for uncoiling and threading of strands into the duct.
- ix) Before concreting, check the entire length of the ducts for any opening or damages. Seal them firmly with the adhesive tape or any suitable sealant.
- x) Both the ends of the duct should be closed after installation, and the strand ends should be wrapped firmly with anti moisture wraps to prevent the ingress of any foreign particles, cement slurry, concrete or moisture inside the duct. They may damage the duct and the strands in long run.
- xi) Precaution should be taken to prevent the sheathing/ducts from getting damaged due to the use of Needle vibrators during concrete. Damage or puncture of Sheathing may cause a severe ingress of cement slurry into the duct and will result in blocking the Strands up to certain length.
- xii) Clogging of strands inside the duct will cause an unequal elongation during stressing and will obstruct the passage during grouting.

9.15. ASSEMBLY OF PRESTRESSING AND REINFORCING STEEL

- i) Pre-stressing Steel
- ii) Straightening
 - a) The wire, as supplied, shall preferably be self-straightening when uncoiled. If it is not so, the wire may need to be mechanically straightened before use. In this event, care shall be taken to avoid alteration in the properties of the wire during the straightening process and preferably a test shall be made on a sample of the wire after straightening.
 - b) In no case heat shall be applied to facilitate straightening or bending of pre-stressing steel.

9.16. ARRANGEMENT OF WIRES AND POSITIONING

- i) All pre-stressing steel shall be carefully and accurately located in the exact positions shown in the design drawings. The permissible tolerance in the location of the pre-stressing tendon shall be +/- 5 mm. Curves or bends in pre-stressing tendon required by the designer shall be gradual and the pre-stressing tendon shall not be forced around sharp bends or be formed in any manner which is likely to set up undesirable secondary stresses.
- ii) The relative position of wires in a cable, whether curved or straight, shall be accurately maintained by suitable means such as sufficiently rigid and adequately distributed spacers.

- iii) The spacing of wires in a cable shall be adequate to ensure the free flow of grout.
- iv) The method of fixing and supporting the steel in the mould or the formwork shall be such that it is not displaced during the placing or compaction of the concrete or during tensioning of the steel.
- v) The type of fixtures used for positioning the steel shall be such that it does not give rise to friction greater than that assumed in the design.

9.17. **Jointing**

- i) High tensile wire other than hard-drawn wire may be joined together by suitable means provided the strength of such joints is not less than the individual strengths of the wires being joined. Hard-drawn wire used in pre-stressed concrete work shall be continuous over the entire length of the tendon.
- ii) Welding shall not be permitted in wires.

9.18. **Cutting**

All cutting to length and trimming of the ends of wires shall be done by suitable mechanical or flame cutters. Where flame cutters are used, care shall be taken to ensure that the flame does not come into contact with other stressed wires or concrete.

9.19. **Protection of Pre-stressing Steel and Anchorages** - In all constructions of the post-tensioned type, where pre-stressing is initially carried out without bond, the pre-stressing tendon shall, at a subsequent date and generally not later than one week after pre-stressing, be given and adequate protection against corrosion.

- i) Internal pre-stressing steel - Internal pre-stressing steel is best protected by a cement grout preferably in colloidal form. The grout shall be placed under pressure, and it shall be ensured that the entire space between the duct and the pre-stressing tendon is properly filled with grout. Where small ducts are encountered, it is advisable that water is flushed through prior to grouting, care being taken to see that all water is subsequently displaced by grout. In the case of butted assemblies, flushing with water shall be carried out only after the jointing material has properly hardened. Injection shall proceed from one end or preferably in case of curved ducts from the lowest point of the curve, and shall be continued until the grout overflows from the other end.
- ii) External pre-stressing steel - The protection of external prestressing steel is usually best done by encasing the tensioned wires, cables or bars in a dense concrete secured to the main concrete, for example, by wires left projecting from the latter. If a cement-sand mix is used, the cover provided and its density should be adequate to prevent corrosion. Alternatively, the steel may be encased in bitumen or, where the steel is accessible for inspection and maintenance, paint protection may be provided.
- iii) The anchorage shall be adequately protected against damage or corrosion soon after the completion of the final stressing and grouting operations.

9.20. **Cover**

- i) In post-tensioned work, where cables and large-sized bars are used, the minimum clear cover from sheathing/duct shall be at least 30 mm or the size of the cable or bar whichever is bigger.
- ii) Where pre-stressed concrete members are located in aggressive environment, the cover specified under (i) above shall be increased by 10 mm.

9.21. **Spacing**

In the case of cables or large bars, the minimum clear spacing (measured between sheathings/ducts, wherever used) shall not be less than greater of the following:

- i) 40 mm,
- ii) Maximum size of cable or bar, and
- iii) 5 mm plus maximum size of aggregate.

9.22. **Grouped Cables**

- i) Cables or ducts may be grouped together in groups of not more than four.
- ii) The minimum clear spacing between groups of cables or ducts of grouped cables shall be greater of the following:
 - a) 40 mm, and
 - b) 5 mm plus maximum size of aggregate.
 The vertical distance between groups shall not be less than 50 mm.

9.23. SHEATHS AND EXTRACTABLE CORES

- i) Sheaths shall be sufficiently water-tight to prevent concrete laitance penetrating in them in quantities likely to increase friction. Special care shall be taken to ensure water tightness at the joints.
- ii) They shall be preferably machine-manufactured and have bores sufficiently large to allow being easily threaded on to the cable or bar in long lengths.
- iii) The tubes or sheaths shall be of such strength as not to be dented or deformed during handling or concreting.
- iv) The alignment of all sheaths and extractable cores shall be correct to the requirements of the drawings and maintained securely to prevent displacement during placing and compaction of concrete. The permissible tolerance in the location of the sheaths and extractable cores shall be ± 5 mm. Any distortion of the sheath during concreting may lead to additional friction

9.24. REINFORCING STEEL

- i) Provisions for assembly of reinforcement given in IS: 456 shall apply.
- ii) The requirements of cover and spacing between bars shall conform to IS:456.

9.25. PRE-STRESSING

- i) Pre-stressing Equipment
- ii) Tensioning Apparatus
 - a) Pre-stressing steel may be tensioned by means of hydraulic jacks or similar mechanical apparatus. The type of tensioning apparatus shall be such that a controlled force can be applied. The tensioning apparatus shall not induce dangerous secondary stresses or torsional effects on the steel, concrete, or on the anchorage.
 - b) The anchorage provided for the temporary gripping of wires or bars on the tensioning apparatus shall be secure and such as not to damage the wire or bar.
 - c) Devices attached to the tensioning apparatus for measuring the applied force shall be such that they do not introduce errors exceeding 5 percent.
- iii) Temporary Gripping Device – Pre-stressing tendons may be gripped by wedges, yokes, double cones or any other approved type of gripping devices. The pre-stressing wires may be gripped singly or in groups. Gripping devices shall be such that in a tensile test, the wire or wires fixed by them would break before failure of the grip itself.
- iv) Releasing Device - The releasing device shall be so designed that during the period between the tensioning and release, the tension in the Pre-stressing elements is fully maintained by positive means, such as external anchorages. The device shall enable the transfer of pre-stress to be carried out gradually so as to avoid large difference of tension between wires in a tendon, severe eccentricities of pre-stress or the sudden application of stress to the concrete.
- v) Anchorage
 - a) The anchorage may consist of any device, patented or otherwise, which complies with the requirements laid down under (ii) to (vi).
 - b) The anchoring device shall be capable of holding without more than nominal slip, the pre-stressing tendon subjected to a load midway between the proposed initial pre-stressing load and the ultimate strength of the pre-stressing tendon.
 - c) The anchoring device shall be strong enough to resist in all respects a force equal to at least the breaking strength of the pre-stressing tendon it anchors.
 - d) The anchorage shall transfer effectively and distribute, as evenly as possible, the entire force from the pre-stressing tendon to the concrete without inducing undesirable
 - e) The anchorage shall be safe and secure against both dynamic and static loads as well as against impact.
 - f) The anchorage shall have provision for the introduction of a suitable protective medium, such as cement grout, for the protection of the pre-stressing steel unless alternative arrangements are made.

9.26. PROCEDURE FOR TENSIONING AND TRANSFER

- i) Stressing
 - a) The tensioning of pre-stressing tendons shall be carried out in a manner that

will induce a smooth and even rate of increase of stress in the tendons.

- b) The total tension imparted to each tendon shall conform to the requirements of the design. No alteration in the pre-stressing force in any tendon shall be allowed unless specifically approved by the designer.
- c) Any slack in the pre-stressing tendon shall first be taken up by applying a small initial tension. The initial tension required to remove slackness shall be taken as the starting point for measuring the elongation and a correction shall be applied to the total required elongation to compensate for the initial tensioning of the wire. The extent of correction shall be arrived at by plotting on a graph the gauge reading as abscissa and extensions as ordinates: the intersection of the curve with the Y axis when extended shall be taken to give the effective elongation during initial tensioning, and this effective elongation shall be added to the measured elongation to arrive at the actual total elongation.
- d) The placement of cables or ducts and the order of stressing and grouting shall be so arranged that the pre-stressing steel, when tensioned and grouted, does not adversely affect the adjoining ducts.

ii) **Measurement of Pre-stressing Force**

- a) The force induced in the pre-stressing tendon shall be determined by means of gauges attached to the tensioning apparatus as well as by measuring the extension of the steel and relating it to its stress-strain curve. It is essential that both methods are used jointly so that the inaccuracies to which each is singly susceptible are minimized. Due allowance shall be made for the frictional losses in the tensioning apparatus.
- b) The pressure gauges or devices attached to the tensioning apparatus to measure the force shall be periodically calibrated to ensure that they do not at any time introduce errors in reading exceeding 2 percent.
- c) In measuring the extension of pre-stressing steel, any slip which may occur in the gripping device shall be taken into consideration.

iii) **Transfer of Pre-stressing Force**

- a) The transfer of the pre-stress shall be carried out gradually so as to avoid large differences of tension between wires in a tendon, severe eccentricities of pre-stressing force and the sudden application of stress to the concrete.
- b) Where the total pre-stressing force in a member is built up by successive transfers to the force of a number of individual tendons on to the concrete, account shall be taken of the effect of the successive pre-stressing.
- c) In the long line and similar methods of pre-stressing, when the transfer is made on several moulds at a time, care shall be taken to ensure that the pre-stressing force is evenly applied on all the moulds, and that the transfer of pre-stress to the concrete is uniform along the entire length of the tension line.

9.27. **GROUTING**

The requirements of the grout are fluidity and low sedimentation (or bleeding) in the plastic state. In the hardened state, it shall be dense, have low shrinkage and be durable. The grouting technique adopted should be such that it can be carried out easily and effectively.

- i) Grout shall be made from any of the cements specified in 4.1 and water conforming to 4.3. If permitted by the engineer-in charge, admixtures may be added to improve the performance of the grout. The water cement ratio for neat cement grouts should not be more than 0.45 by mass.
- ii) The compressive strength of 100 mm cubes of the grout shall not be less than 17 N/mm² at 7 days. Cubes shall be cured in a moist atmosphere for the first 24 hours, and subsequently in water.
- iii) **Grouting Equipment**
 - a) The mixer shall be of a high speed mixing type, capable of mixing with high local turbulence while imparting only a slow motion to the body of the grout. A grout screen should preferably be fitted.
 - b) The pump and the injection equipment shall be capable of continuous operation with little, if any, pressure variation and shall have a system for re-circulating the grout while actual grouting is not in progress. No compressed air system should be used for grouting work. The pumping equipment shall be able to deliver the grout

- at a nozzle pressure of at least 0.7 N/mm².
- c) All piping to and from the grout pump shall have a minimum of bends, valves, and changes in diameter and the delivery hose shall be as short as practicable.
- d) All piping, pumping and mixing equipment should be thoroughly washed with clean water after each series of operations or more frequently if necessary. In any case the intervals between the washings shall not exceed 3 hours.
- iv) Mixing - Water shall be measured and added to the mixer first, followed by cement. When these are thoroughly mixed, the additive and sand, if any, shall be added. When all the ingredients have been added, mixing shall continue for at least two minutes.
- v) Duct Preparation - Ducts shall be kept clean at all times. Unwanted opening at anchorages and in any other locations shall be sealed before grouting commences. In all long ducts, or in any duct where considerable changes of level occur and in any large diameter ducts, grout vents shall be provided at all crests and at intervals of 20 m to 30 m so that grout can be injected successively through vents as the grout flows along the ducts. Where water is likely to enter ducts, valley vents shall also be provided for drainage.
- vi) Grout Injection - Grouts should be injected from the lowest point or 'uphill' wherever practicable so that air and water in the duct, being less dense than the grout, will be pushed ahead of the grout mix and be less liable to become entrapped in the grout mix. Grout mix shall be allowed to flow through vent openings until its consistency is equivalent to that of the grout injected. Vent openings shall then be firmly closed one after the other in the direction of flow. Once good grout mix has commenced to flow freely from the end or ends of the duct, that end or ends shall be closed and the pressure built up inside the duct to 0.7 N/mm² before closing the injection end. In the case of large ducts where pressure grouting cannot be used, a standpipe or vent pipe shall be provided and kept topped up with cement for an hour or two to replace grout losses due to wastage and subsidence at the termination of grouting operation.

i. TRANSPORTING, PLACING, COMPACTING AND CURING

- i) Provisions given in IS: 456 shall apply. In addition, to instructions given by Engineer in charge shall also apply.
- ii) The use of construction joints in pre-stressed concrete work should preferably be avoided. But, if found necessary, their position and arrangement shall be predetermined by the designer.
- iii) Jointing of Butted Assemblies
 - a) The joints of butted assemblies shall be made of either cement grout or cement mortar or concrete. Grouting shall be used for joints up to 12 mm thick. For joints thicker than 12 mm and preferably for thicknesses between 18 and 25 mm, mortar shall be used. The mortar which may be made of one part cement and one and-a-half parts sand shall be of a dry consistency and shall be packed hard in layers so that it rings true. Where joints exceeding 75 mm are encountered, the joint shall be made up of concrete.
 - b) The stressing operations may be carried out in case of mortar joints immediately after placing the mortar but the stress in the mortar shall not exceed 7.0 N/mm². In the case of grouted joints and concrete joints the allowable stress in the first 24 hours after placing of the grout or concrete in the joint shall approximate as closely as possible to the strength of the grout or concrete used.
 - c) The holes for the pre-stressing tendons shall be accurately located and shall be in true alignment when the units are put together.
 - d) Full tensioning shall not be carried out until the strength of the concrete or mortar in the joint has reached twice the transfer stress.

ii. ANCHORAGES AND BLOCK-OUTS

- i) Attachment
 - a) Attach anchorages securely to bulkhead forms/end shutter using fasteners/bolts such that the anchor is perpendicular to the tendon axis.
- ii) Cover: Top, bottom, and edge concrete cover for anchorages shall be not less than the specified cover for reinforcement. Minimum concrete cover from the exterior edge of the concrete to wedge cavity area of anchor shall be 2 inches, unless otherwise noted on the drawings.

iii. Block-outs and Pockets

- i) Adequately reinforce all block-outs or pockets required for anchorages so as to not

- decrease the strength of the structure.
- ii) Pocket formers used to provide a void form at anchorages shall be designed to prevent intrusion of concrete or cement slurry into the wedge cavity.
- iii) Do not coat block-out forms or pocket formers with grease, form oil, or any other substance that will decrease the bonding capacity of the patching grout to the surrounding concrete.
- iv) Install sleeves and seals connecting sheathing to anchorage to completely seal tendon against moisture infiltration.

iv. Measurements

For the purpose of payment length of strands only shall be measured from outer face of concrete member at one end to outer face of concrete member at another end and shall be paid in per Kilogram. Extra length of strands provided on both the ends for anchorage and stressing shall not be measured and paid. Steel bar chairs, anti bursting and anti spalling reinforcement and other reinforcement bars shall be measured and paid under relevant item of reinforcement bars. Concreting of patches left out for Post- tensioning shall be measured and paid under relevant item of concrete. All work shall be completed as per latest IS codes and PIU/ Relevant Specification/Relevant Codes/ Relevant Circular/CPWDs.

v. Rate

Rate for the post tensioning work shall include all material and operations described above except material and operations related to Un-tensioned reinforcing Steel work and concrete work required and provided for post tensioning work.

10. FLOORING & WALL LINING.

10.1. GENERAL (APPLICABLE FOR ALL KINDS OF FLOORING AND DADO/CLADDING WORKS UNDER THIS SUB-HEAD):

- i) The work under this sub-head in general shall be carried out as per the PIU/ Relevant Specification/Relevant Codes/ Relevant Circular/CPWDs, as per the architectural drawings and as per the direction of Engineer-in-Charge.
- ii) The Engineer-in-Charge or his representative may, if required, visit the source of supply of the various stones to assess the quality as well as availability of the material in the required quantities. The Department shall bear the cost of such visits of the officers of the Department.
- iii) Based on the samples approved by the Engineer-in-Charge for various flooring and dado / cladding materials as specified hereinafter, the contractor shall prepare mock up(s) at site of work as specified under relevant flooring and dado / cladding items, for approval of quality of workmanship and material specified. If the quality of the workmanship and the material is as per the required standards and approved by the Engineer-in- Charge, the mock up shall be allowed as part of the work and measured for payment. Otherwise, it shall be dismantled by the contractor as directed by the Engineer-in-Charge and taken away from the site of the work at his own cost. The mock up(s) so made shall be kept till completion of respective works for reference. Nothing extra shall be payable on this account.
- iv) The stones / tiles shall be transported to site well packed in boxes or otherwise. These shall be handled carefully to prevent any damage. The various types of stones and tiles, procured shall be free of any surface defect or any edge damage. The damaged stones and tiles shall not be allowed to be used in the work. So, the contractor shall procure additional quantity of the stone and tiles to cover such contingencies. However, nothing extra shall be payable on this account.
- v) For the enclosures with circular or curved profile, only the actual area of the flooring shall be measured for payment and nothing extra shall be payable for labour, material, wastages and any other incidental charges.
- vi) For the skirting in the enclosures with curvilinear profiles, the tiles / stones shall be cut to the required size and the shape to match the profile and/ or the joints as per the architectural drawings. Similarly, the skirting shall be fixed in a manner as to flush or project from the finished face of the wall as per the architectural drawings and as directed by the Engineer - in - Charge. Any chasing of the C.C masonry blocks required for such fixing is deemed to be included in the cost of masonry. Nothing extra shall be payable on this account.
- vii) For flooring work, the joints between the different types of flooring shall be located as

per the architectural drawings and the measurement shall be done as per item description. Also, the Contractor shall maintain the uniform level of the finished flooring of the different types unless specifically mentioned on the architectural drawings. Nothing extra shall be payable on these accounts.

- viii) All the flooring works specified under this sub-head shall be adequately protected by a layer of plaster of paris which shall be laid over a 400 micron PVC film. The protective layer shall be maintained throughout the execution of works and removed just before handing over of the site for which nothing extra shall be payable.
- ix) At the time of handing over, flooring & dado / cladding shall be free of any scratches, stains etc. The flooring & dado / cladding shall be properly cleaned before handing over. However, abrasive cleaners shall not be used to clean the marks and other scratches.

10.2. **GRANITE WORKS**

- i) The granite stonework shall, in general, be carried out as per the PIU/ Relevant Specification/Relevant Codes/ Relevant Circular/CPWDs. The specifications for dressing, laying, curing, finishing, measurements, rate etc. for the granite stone flooring shall be same as that of works for the Marble flooring, skirting and risers of steps under Flooring Sub Head of the PIU/ Relevant Specification/Relevant Codes/ Relevant Circular/CPWDs. The wall lining / veneer work with granite stone shall be as per the PIU/ Relevant Specification/Relevant Codes/ Relevant Circular/CPWDs for Marble work Sub Head.
- ii) Granite stone tiles and slabs shall be pre polished (mirror polished), eggshell polished, flame finished or given any other surface treatment as specified in architectural drawings and as directed by the Engineer- in-Charge.
- iii) Machine polishing and cutting to required size shall be done with water (as lubricant) only. Sawing shall also be done preferably with water as lubricant but as a special case, the Engineer-in-Charge may permit, at his discretion, oil or kerosene as lubricant subject to all kerosene or oil in the body and surface of tiles / slabs being thoroughly dried in ovens. Tiles / slabs with stains or patches due to the use of oil or otherwise, either before or after installation, shall be rejected and shall be replaced by the Contractor at his own cost. Nothing extra shall be payable on this account.
- iv) Granite stone slabs shall be individually packed in cardboard paper.
- v) These shall be handled carefully to prevent any damage. The stone slab procured shall be free of any surface defect or any edge damage. The damaged stones shall not be allowed to be used in the work. So the Contractor shall procure additional quantities to cover such contingencies. However nothing extra shall be payable on this account. The stone slabs shall not be waxed or touched up with dyes / colours.
- vi) The granite stone slabs to be procured for the work shall match the samples shown to the Contractors before submission of the Bids. Before starting the work, the Contractor shall procure and submit the samples of granite stone slab (matching to the samples shown to the Contractors before submission of the Bids) for the approval of the Engineer-in-Charge. The samples shall be submitted along with the following details:
 - a) Three representative samples for each type of granite stone specified.
 - b) Details of physical characteristics such as dimensional tolerances (within the specified limits), water absorption, compressive strength, Mohs Hardness, Specific gravity with reference to IS or International standards.
 - c) Source of supply and confirmation of availability in full quantity and uniformity of colour, tone and textures.
 - d) Company profile of Suppliers.
 - e) The decision of the Engineer-in-Charge as regards the approval of the samples for the various types of the granite stones shall be final and binding on the Contractor. No claim of any kind whatsoever shall be entertained from the Contractor on this account. The Contractor shall then procure and get the mock up prepared at site of work for approval of quality of workmanship and the granite stone as specified. The mock up shall be prepared, on one of the floors at the location as decided by the Engineer-in-charge. The size of the stones shall be as per the architectural drawings. If the quality of the workmanship and the material is as per the required standards, the mock up shall be allowed as part of the work and measured for payment and shall not be dismantled. Otherwise, it shall be dismantled by the contractor as directed by the Engineer-in-Charge and taken away from the site of the work at his own cost. Nothing extra shall be payable on this account.
 - f) The mock up (one each) shall be prepared in places wherever decided by Engineer-in-charge.
- vii) The entire supply for each type of granite stone slab shall be procured from

one location (in one quarry), and supplied preferably, in one lot to keep variation to the minimum. The Contractor shall also segregate and sort the slabs according to colour, shade, texture and size of grains etc. to keep variation (s) in stone used at any one floor to the minimum. Any slab with variation in the colour, shade, texture and size of grains etc., not acceptable to the Engineer-in-Charge, shall not be used in the work and shall be removed and replaced by the Contractor. Nothing extra shall be payable on these accounts. Also, no claim of any kind shall be entertained from the Contractor on this account.

- viii) The stone work may be required to be carried out in patterns, design and / or in combination with granite stones of different colour and shade with or without borders and in combination of different stone slabs / ceramic tiles for which nothing extra shall be payable. The stones shall be provided in sizes and shapes as per the approved architectural drawings and wastages and incidental costs, if any, shall be deemed to be covered in the cost of the relevant items. Nothing extra shall be payable on this account. For the purpose of payment, only the actual area of each type of granite stone provided and fixed shall be measured separately under the relevant items.

- ix) The following tolerances shall be allowed in the dimension of granite stone slab:

Slabs:	Tolerance
a). Length	±1mm
b). Width	±1mm
c). Thickness	- 1mm
d). Angularity at corners	±0.25%

The stone (slab and tiles) not meeting the above tolerance limits shall be rejected and not permitted to be used in the work. Nothing extra shall be payable on this account.

- x) Stone slab shall have uniform thicknesses within the tolerance limits and linear items like treads, sills and jambs, coping, risers, urinal partitions, kitchen/wash basin platforms, vanity counters, facias and others similar location etc. shall have edge polished calibrated thickness i.e. exposed edges shall have edge polished uniform thickness throughout the length of the work. Nothing extra shall be payable on this account.

- xi) The flooring work shall be carried out as per the architectural drawings in design and pattern (geometric, abstract etc.) and in linear and / or curvilinear portions and in combination with stones of different colour and shade and ceramic tiles etc. For the flooring portions curved in plan, the stone slabs (at the edge) shall be cut to the required profile and shape as per the architectural drawings. Nothing extra shall be payable on this account and any consequent wastages and incidental charges on such accounts shall be deemed to be included in the cost of such items. For the purpose of payment, the actual area of each type granite stone as laid shall be measured separately under the relevant items.

- xii) The granite slabs used for providing and fixing in the sills, soffits and jambs of doors, windows, ventilators and similar locations shall be in single piece unless otherwise directed by the Engineer-in-Charge. Wherever stone slab other than in single piece is allowed to be fixed, the joints shall be provided as per the architectural drawings and as per the directions of the Engineer-in-Charge. In the cabin areas, the joints in sills shall preferably be provided in line with the partition wall. Depending on the number of joints, as far as possible, the stone slabs shall be procured and fixed in slabs of equal lengths as per the architectural drawings and as directed by Engineer-in-Charge.

- xiii) The specifications for dressing, laying, curing, finishing, measurements, rate etc. for the granite stone flooring shall be same as that of works for the Marble flooring, skirting and risers of steps under Flooring Sub Head of the PIU/ Relevant Specification/ Relevant Codes/ Relevant Circular/ CPWDs. The wall lining / veneer work with granite stone shall be as per the PIU/ Relevant Specification/ Relevant Codes/ Relevant Circular/ CPWDs for Marble work Sub Head.

10.3. KOTA STONE WORK

- i) The Contractor shall procure and submit the samples of the kota stone for flooring as well as risers and treads in the staircase, for the approval of the Engineer-in-charge prior to the execution of the item.
- ii) Mock up (one no.) shall be prepared for staircase (tread as well as riser).
- iii) All the Kota stones shall have uniform colour and shade. So, the entire quantity shall be obtained, preferably, in one lot from one location (in one quarry) to keep variation to the minimum. The Contractor shall also sort, segregate and use the stone slabs, according to

colour, shade, etc. at any one location to keep variation in the colour, shade etc. in stones used to the minimum. Any stone slab with a variation, not acceptable to the Engineer-in-Charge, shall not be used in the work and shall be removed and replaced by the Contractor at his own cost. Nothing extra shall be payable on these accounts. Also, no claim of any kind shall be entertained from the Contractor on this account.

- iv) The exposed cut edges of the Kota Stone slab in risers and treads along its width (sides of the risers and treads of the steps i.e. along the shorter dimensions of the kota stone slab for the risers and treads) shall be polished in a workmanlike manner. The top exposed edge of the kota stone skirting shall also be polished in a workmanlike manner. Nothing extra shall be payable on this account.
- v) Nosing / edge moulding shall be provided to the front edge of the Kota stone slab treads along its length i.e. along the longer dimensions of the kota stone slab, as per the architectural drawings. The payment of the same shall be made separately under relevant item.

11. FINISHES WORK(WoodWork)

11.1. GENERAL

- i) The wood work in general shall be carried out as per PIU/ Relevant Specification/Relevant Codes/ Relevant Circular/CPWDs 2009
- ii) Specified timber shall be of good quality and well-seasoned. It shall have uniform colour, reasonably straight grains and shall be free from knots, cracks, shakes and sapwood. It shall be close grained.
- iii) Wood work shall not be painted, oiled or otherwise treated before it has been approved by the Engineer-in-Charge.
- iv) All portion of timber including architrave abutting against masonry, concrete, stone or embedded in ground shall be painted with approved wood preservative or with boiling coal tar.
- v) Anti-termite Treatment and fire retardant paint to be provided of approved brand and manufacturers as directed.
- vi) All fittings and fixtures shall be got approved from the Engineer- in-Charge before procurement well in advance and the approved samples shall be kept at site till completion of the work.
- vii) The timber to be procured for the work shall match the samples shown to the Bidders before submission of the Bids. Before starting the work, the Contractor shall procure and submit the samples of timber (matching to the samples shown to the Bidders before submission of the Bids) for the approval of the Engineer-in-Charge.
- viii) The samples of species of timber to be used shall be deposited by the contractor with the Executive Engineer before commencement of the work. The contractor shall produce cash vouchers and certificates from standard kiln seasoning plant operator about the timber section to be used on the work having been kiln seasoned by them, failing which it would not be so accepted as kiln seasoned.
- ix) Factory made shutters, as specified shall be obtained from factories to be approved by the Engineer-in-Charge and shall conform to IS: 2202 (Part-I) 1991. The contractor shall inform well in advance to the Engineer-in-Charge the names and address of the factory where from the contractor intends to get the shutters manufactured. The contractor will place order for manufacture of shutters only after written approval of the Engineer-in-Charge in this regard is given.
- x) The contractor is bound to abide by the decision of the Engineer- in-Charge and recommend a name of another factory from the approved list in case the factory already proposed by the contractor is not found competent to manufacture quality shutters. Shutters will however, be accepted only if this meet the specified tests. The contractor will also arrange stage wise inspection of the shutters at factory by the Engineer-in-Charge or his authorized representative. The contractor will have no claim if the shutters brought at site are rejected by the Engineer-in-Charge in part or in full lot due to bad workmanship/quality. Such shutters will not be measured and paid. The contractor shall remove the same from the site of work within 7 days after the written instructions in this regard are issued by the Engineer-in-Charge.

11.2. TESTING

- i) The shutters shall be tested for species, seasoning & treatment, defects in the timber, panel material, construction & workmanship in the approved Laboratory at the frequency mentioned in PIU/ Relevant Specification/Relevant Codes/ Relevant

Circular/CPWD 2009.

- ii) If shutters are found defective in any one of the criterion double the shutter shall be tested & if found permissible can be accepted. If shutter is found defective in more than one criterion, the whole lot shall be rejected.
- iii) Finish
 - a) All components of door shutter shall have smooth finish.
 - b) Panels of the door shutters shall be flat and well sanded to a smooth and level Surface.
 - c) All the surfaces of door shutters which are required to be painted or polished or varnished shall be got approved from the Engineer In Charge before applying protective coat of primer, polish or varnish.

12. FALSECEILING

12.1. GENERAL

- i) Work shall in general be carried out as per the PIU/ Relevant Specification/Relevant Codes/ Relevant Circular/CPWD. Modular and acoustical false ceiling shall be provided and installed in all areas. All ceilings in the office areas, pantry and all service areas shall be openable. A Combination of fixed board ceiling and openable tiles is used in the interiors for visual effect as long as the majority of the ceiling is openable.
- ii) Modular acoustical tile ceilings with high reflectivity of light and recessed grid is to be provided meeting with the international standards.
- iii) False ceiling shall be coordinated with the services to achieve maximum height from the finished floor level in the office areas with cove lighting.
- iv) The false ceiling material shall be of calcium silicate board, aluminium, acoustic modular tiles or mineral fibre ceiling tiles. The technical assistance and guidance is to be taken from the respective approved manufacturers and work shall be done strictly according to the manufacturers specifications and manuals. Material from original source shall only be used.
- v) A sample of each finish shall be got approved before proceeding for bulk production. GI framing shall be erected as per recommendation of the manufacturer specification and approval of CPWD
- vi) No sagging, unlevelled stretch of work or chipped tiles shall be accepted. Contractor shall take full responsibility for its firmness with the structure.
 - a) The false ceiling comprises of Gypsum board, Acoustical Ceiling Tiles and Metallic Tiles.
 - b) The calcium silicate board false ceiling is to be in different shapes such as Vaults, Coffers, cove's and plain in unison with Acoustical Ceiling Tiles and Aluminium Tiles Ceiling. The technical assistance and guidance is to be taken from manufacturers and work has to be done according to the manufacturer's specifications and manuals.
 - c) A sample of each finish shall be got approved before proceeding for bulk production. GI framing shall be erected as per recommendation of the manufacturer specification and approval of the Engineer-in-charge. The main contractor shall engage specialized agency and submit its credentials to Engineer-in-charge for approval. The criteria for setting the terms and conditions shall be broadly in line with CPWD criteria for similar works. The work shall be taken up only when specialized agency is approved in writing by Engineer-in-charge.
- vii) False ceiling work shall be carried out in accordance with the actual site conditions at different /split-levels. Any sagging, unlevelled stretch of work shall be redone /replaced and made good, at no extra charge, to the satisfaction of Engineer-in-charge. No compensation shall be paid on account of provision /coverage of openings for lighting fixtures, air-conditioning ducts and the likes as detailed in drawings and/or directed.

13. ACOUSTICAL SPECIFICATION FOR AUDITORIUM

- 13.1. Providing and **Fixing** Armstrong or equivalent in other make Channelled Woodworks perforated panels of width 128mm, thickness of 15mm and length 2440 mm or as required by the Architect/ approving engineer, made of a high density fibre board with minimum 830 Kg/M³ density substrate with a laminated facing / wood veneer as per the approved shade/ species & finish and a melamine balancing layer on the reverse side. The boards shall have a special perforation pattern where the visible surface has a "Helmholtz" fluted perforation of 2mm width and 14mm of visible panel each. The panels shall provide a fire reaction of Class of 1 as per Part 7 of BS 476. The edges of the panels shall be "tongue-and-grooved" to receive special clips for installation. The back of the perforated panel shall have sound absorbing non-woven acoustical fleece having NRC of

0.55. The panels shall be mounted on special aluminium splines using clips provided by Armstrong/equivalent and approved by the Architect/ Engineer-in-Charge.

- 13.2. Install wooden battens (provided by others) of section 50mmx50mm or as approved by the Architect on the solid wall horizontally using screws and plugs at spacing of 600mm centre-to-centre. Screw the aluminium extruded keel for channelled woodworks (GTPT001) provided by Armstrong over the lowest and second wooden batten at an on-centre distance of 600mm. Install the first set of wooden panels by inserting the clips for border channelled woodworks (GTPT002) and insert the groove of the panel into the projecting flange of the aluminium clip. Continue installing rows of panels by inserting the tongue into the groove of the earlier inserted panel and progressively installing clips for inside channelled woodworks (GTPT003) into the next keel till the actual height is achieved. Use clips for border channelled woodworks (GTPT002) to finish off the installation. Finish off the edges using wooden moulding of matching colour (provided by others). Acoustics – NRC upto 0.75

Note -It should be ensured that before actual installation at site all the material shall be got tested as per specified code . The testing charge shall be born by the contractor. The rate shall be inclusive of all material , labour required for finishing the item and for all height.

- 13.3. Providing and supplying Armstrong or equivalent in other make 'Optra Acoustical Wall Paneling' with square edges made of fibre glass substrate 25mm thick and wrapped on the front side with an acoustically transparent and classified for Fire reaction Class B-s1, d1 as per EN13501, fabric with an option of colors – Ivory, Autumn Orange, Pista Green, Straw Gold, Rustic Green, Burgundy, Rust, Peacock Blue, Ash Grey, Mocha as per the choice of the Architect of size 600X2100 mm providing a minimum sound absorption level of 0.90 NRC to be affixed to wall using Wall panel impalers supplied by M/s Armstrong Industries India Pvt. Ltd/equivalent and construction adhesives as per the instructions laid down by the manufacturer.

- 13.4. 4nos. Armstrong/equivalent wall panel Impalers of shall be fixed to the wall surface using self tapping screws. Silica based construction adhesive to be dabbed on to the projecting elements (spikes) of the impalers. Armstrong Optra wall panels shall be pierced through the spikes of the impalers ensuring the line and level of the panels are maintained.

i) Providing and fixing 150mm x20mm Sal wood band finished with walnut sprit polish in line and level keeping 8mm groove including base of GI struds

- 13.5. Supply and Installation of Anutone/equivalent make Mat Ebony square edge Magnesite bonded pinewood microfibre core ceiling tiles or approved equivalent of size 595x595x15mm having density 600 kgs/m³, weight 9kg/m² which is suspended by using 0.35mm thick and 15mm wide pre coated metal T15HD grid system.

- 13.6. The T15HD Grid system of 600x600mm module shall include wall angle (WA15W30) with unequal flanges of size 14&20mm wide, length 3000mm, 0.43mm thick fixed along the perimeter of walls with the help of nylon sleeves and suitable fasteners at 300mm centers. Then suspend the Main T15HD (MT15W36) having flange width 15mm, height 32mm and length 3600mm from the soffit with help of soffit cleat and wire rod with leveling spring clip at 1200mm c/c. Cross T15HD (CT15W12) having flange width 15mm, height 32mm and length 1200mm is then interlocked into the pre-cut slots in the Main T15 at 600mm centers in the direction perpendicular to the Main T15HD. Finally Cross T15HD (CT15W06) having flange width 15mm, height 32mm and length 600mm are then interlocked into the pre cut slots in the 1200mm Cross T15HD at 1200mm centers and in direction parallel to the Main T15HD. Mat Ebony square edge of size 595x595x15mm thick shall be placed into the grid size of 600x600mm.

- 13.7. The system is backlined with the acoustical infill Anutone Synth/equivalent PF 10X50mm thick.

Technical Parameters

- a) Core Pinewood Particles
- b) Fire – Class 1 & P
- c) Acoustics – NRC upto 0.9
- d) Climate (OC RH) – 50, 90
- e) Termite resistance – Yes
- f) Light reflectance – Low
- g) Green (RC %) – 25

- h) Hygiene (VoC, Clean room) – Low, Class 3
- i) Strength, Load capacity (Kg) - Antisag, Ball-Impact

13.8. Supplying & installation of fabric upholstered chair with C-Frame mechanism made of 3mm thick stamped MS Sheet component for Auto-tip seat movement. The chair to have centre to centre distance of 535 to 560mm and to be mounted on side/centre foot made out of MS tubular section of size 80mm X 40mm X 2mm. The chair shall have powder coating not below 50 microns on all exposed MS framework. The seat cushion shall have Polyurethane moulded foam of Density 45+-5 KG /cum with integrated MS structure for extra strength. The chair backrest to integrate moulded hot pressed ply of 15mm thickness and back PU of density of 40+-5Kg /cum.

The height of the back to be 800-1020mm from the ground to top of the Back (Low Back) & for the seat to be 400-450mm from the ground. The full backrest assembly of the chair to be fabric clad. The chair to be upholstered in fire retardant treated fabric with 5 mm foam lamination for durability. Melamine polished wooden armrest to be placed on common powder coated 2mm MS plate which shall be mounted on two extended 6mm thick MS strips for support. The armrest between two chairs in a row to be shared, including fixing of the chair with expandable fasteners of M8X100 length of Hilti/Fischer make on hard RCC/PCC floor, complete as per drawings, specifications and direction of Engineer-in-charge.

14. GLASSREINFORCED CONCRETE SCREEN

14.1. Providing and fixing Glass reinforced concrete (GRC) screens synthetic rubber /FRP moulded in size, pattern, design, thickness and colour of approved quality/make(Unistone GRC screen 1003 or approved equivalent). The screens made of 53 grade white cement, quartz, fine silica sand, alkali resistant glass fibre, super plasticiser, polymers and UV resistant synthetic inorganic pigments etc including dry fixing with stainless steel 316 grade "L" shaped cramps, dash fasteners etc complete.

15. HARDWARE

- i) Providing and fixing Stainless steel satin finish (SS-316) (unless otherwise specified) hardwares including all necessary screws, nails, adhesive, Cutting in door frames, shutters, floors and providing all other necessary fixing arrangement and fixing of all accessories as per manufacturers specification etc complete as per direction of Engineer-In-Charge. Master key/Grand Master Key provisioning for the doors to be given as per the requirement.
- ii) D shape approved design Lever Handle with ss back plate /on Roses & escutcheons. Including Sash lock with 72mm CTC, 55mm Backset, 20mm Square forend. with 60mm length Euro profile knob cylinder with internal thumb turn and external key operation standard
- iii) D type Pull Handle, back to back with adjustable fixing for glass, wood and metal doors in satin stainless steel. The pull handles should have supporting washer with raised bevelling on the outer surface. Length =350mm, 25mm dia, -SS304
- iv) Lever handle package with SS back plate D shape pure with WC lock with 78mm CTC, 55mm Backset 20mm Square forend complete set. Inside thumbturn and outside indicator/cointurn
- v) Dead Lock 278 Lock compete package of approved make with 55mm backset, 20mm square forend prepared for euro profile cylinder including strike plate. And EPC 60mm Length internal thumb turn & external key operation as per requirement.
- vi) Door Guard Satin nickle plated.
- vii) Flush Bolt of size 300mm & 172
- viii) Door viewer with flap for 180deg angle viewing adjustable and suitable for door thickness 35-55mm in SS Finish.
- ix) Floor stop half dome with 45mm dia with fixing accessories , in SS 316 grade
- x) Door Stopper twin screw
- xi) Door Closer with rack and pinion technology upto 1100 mm door widths, TS 71 make Spring size EN 3/4 .
- xii) Pull Handle 1200mm Length

16. EPOXY FLOORING SYSTEM

- i) Surface preparation by grinding the surface, cleaning the surface thoroughly & removing

- laitance completely.
- ii) Providing and applying FLOWPRIME AS PRIMER COAT and allow it dry.
- iii) Providing and laying self levelling epoxy top coat of FLOWSHIELD SL in 2mm thickness in approved Color, which should have, solvent free, compressive strength > 60N/mm², flexural strength > 40N/mm² and tensile strength > 25N/mm² as per BS6319.

17. TOILETCUBICAL SYSTEM

- i) Providing and fixing toilet cubical systems of approved equivalent make and manufactured in standard dimensions of 600mm width door size with 12mm thick solid Compact Laminate panels made of KRAFT paper impregnated with Phenolic resins under high pressure and temperature, including doors, pilasters & intermediate panels, which should be resistant to heat, bacteria, water, chemical, scratch and impact. Finished product should be as per approved texture, shade & drawing detailing and developed according to IS-2046 and BS-476/97 standards. The toilet cubicle setup shall include necessary hardware fittings, made out of stainless steel (Grade-316), as per manufacturer's specifications and approved by Engineer-in-charge. Hardware fittings should consist of
 - a) Stainless steel Door knob
 - b) Stainless steel Gravity hinges (3 nos.) not less than 75mm length and weight not less than 210 grams
 - c) Stainless steel Thumb-turn lockset with indicators
 - d) Stainless steel Coat hook with nylon door stopper
 - e) Stainless steel U-channels of 20 gauge and 12X20mm size
 - f) Stainless steel Adjustable foot/pedestal to give 150mm clearance from bottom and of weight not less than 600grams.
 - g) Stainless steel Top rail pipe(OD:24mm of 18 gauge) with corner connectors
 - h) Stainless Steel Head Rail Tubular Holder of weight not less than 200 grams.
 - i) Rubber noise deafening tape
 - j) Stainless steel Screws and wall plugs.

18. SPECIFICATION OF OUTDOOR SPORTS FLOORING SYSTEM

- i) Supply and Installation of Polypropylene open top design for Basketball, Volleyball, Badminton and tennis Sports Flooring (incl. installation with line marking as recommended by standards)

Product specification:

Dimension- 250mmx25mmx13mm

Individual legs support- 793

Integrated locks- 4 per side

Weight- 215g

Friction (ASTM C 1028)- Dry-0.83, Wet-0.63

Ball Rebound (DIN 18032-02)- 98%

Load Bearing Capacity (DIN 18032-02)- 180 psi

Compassion vs. Crush (ASTM D 3998)-No Break

Fungus Resistance (ASTM G 21)- No Growth
- ii) Supplying and fixing in position Basket ball Goal Post with net / Lawn Tennis net and Posts/ Badminton net and post of standard sizes as follows
 - a. A technically sophisticated construction with many safety areas such as welded corners and polished surface.
 - b. Made with High - quality 4" thick branded MS pipe & Epoxy Paint (MRF).
 - c. Rust & Corrosion Free.
 - d. Zero Vibration Technology
- iii) Supply and installation of permanent goal post of GI make and good quality net as specified by FIFA international standards

19. PARTICULARSPECIFICATIONSFORWOODWORK,FACTORYMADEDOORSANDWOODEN FIRE RESISTANTDOOR (FRD) FRAMESANDSHUTTERS

19.1. GENERAL

- i) The work in general shall be carried out as per the PIU/ Relevant Specification/Relevant Codes/ Relevant Circular/CPWDs.
- ii) The glue / wooden adhesive to be used for this sub-head shall be PVAc based adhesive, of approved make (Fevicol of Pidilite Industries Ltd. or Korlok of National).

19.2. WOODWORK

- i) The work in general shall be carried out as per the PIU/ Relevant Specification/Relevant Codes/ Relevant Circular/CPWDs.
- ii) The wood shall be selected best quality second-class teak wood.
- iii) The work shall be carried out in accordance with the architectural drawings issued by the department. The architectural drawings shall at all times be properly correlated and architectural requirements have to be fully satisfied.
- iv) All the wood used for the manufacturing of the door shutters including the door frames, internal & external lipping, beading for fixing glazing etc. shall be seasoned as per the requirements of the PIU/ Relevant Specification/Relevant Codes/ Relevant Circular/CPWDs.
- v) All the screws used for woodwork shall be fully threaded, counter sunk stainless steel screws, grade 304 and they shall be suitably concealed or plugged.

19.3. FACTORY LAMINATED FLUSH DOOR SHUTTERS

Factory Laminated Flush Door Shutters of Merino or equivalent make with Teakwood Lipping and Hinges as per the specifications and instructions of Engineer in charge are proposed.

19.4. DECORATIVEHIGH PRESSURELAMINATE

- i) The work in general shall be carried out as per PIU/ Relevant Specification/Relevant Codes/ Relevant Circular/CPWDs.
- ii) The contractor shall procure and submit to the Engineer-in-Charge, samples of laminate for approval. After approval of the samples, the contractor shall prepare a mock up for approval. The material shall be procured and the mass work taken up only after the approval of the mock up by the Engineer-in-Charge.
- iii) Each type of laminate shall be obtained from only one of the approved manufacturers as specified and in one lot. Adequate spare quantity shall be ordered to cover for any damaged sheet and for replacement by the Contractor till the completion of the work.
- iv) The Contractor shall ensure that the edges of the laminates do not come out or chip / peel off during cutting and fixing of the laminates. Defective work on this account shall not be accepted and shall be redone by the contractor at his own cost.

19.5. FIRE DOORS (METAL)

- i) This specification covers the design, supply of materials, Manufacture and installation of factory made special type of approved make steel fire doors of 2 Hrs rating.
- ii) All standards, specifications, acts, and codes of practice referred to herein shall be the latest editions including all applicable official amendments and revisions. List of certain important Indian Standards, Acts and Codes applicable to this work is given below. However, the applicable standards and codes shall be as per but not limited to the list given below:

IS : 277	Galvanised steel sheet (plain and corrugated)
IS : 3614 (Part-2) 1992	Metallic and non-metallic fire check doors – Resistance test and Part – 2 performance criteria.

- iii) Test Report of the Prototype: The door frames and shutters shall be fabricated from approved manufacturers with materials and specifications identical to those for the prototype test report in accordance with IS:3614 (Part-2) 1992 for prescribed fire rating either by CBRI Roorkee or by the Quality Marking Centre for Engineering Goods, Department of Industries, Bahadurgarh, Haryana, ARAI, National Test House of Govt. Of India shall be submitted to the Engineer-in-charge, and execution of the work shall commence only after obtaining his approval in writing. The test report shall include the information prescribed in clause 10 of IS:3614 (Part 2) 1992.
- iv) Testing: The Engineer-in-charge may select, out of the fire door and shutter, assemblies brought at site, random samples for testing either at CBRI Roorkee or at the Quality Marking Centre for Engineering Goods, Department of Industries, Bahadurgarh Haryana, ARAI, National Test House of Govt. Of India. The contractor shall make all arrangement for

- testing of the sample as per IS:3614(Part2)1992 and submit the test result to Engineer-in-charge. In case the test result is satisfactory testing charges (which include the cost of sample and transportation) shall be paid by Engineer-in-charge. If the test result indicates that the fire door assembly does not conform to the requirement of IS:3614(Part2)1992 for FD/60/120/180, the entire lot of the material shall be rejected. In later case, no testing charges shall be paid.
- v) The Contractor shall furnish all materials, labour, operations, equipment, tools & plant, scaffolding and incidentals necessary and required for the completion of all metal work in connection with steel doors, as called for in the drawings, specifications and bill of quantities which cover the major requirements only. Anything called for in the Bid documents shall be considered as applicable to the items of work concerned. The supply and installation of additional fastenings, accessory features and other items not specifically mentioned, but which are necessary to make a complete functioning installation shall form a part of this contract.
- vi) All metal work shall be free from defects, impairing strength, durability and appearance and shall be of the best quality for purposes specified made with structural proprieties to withstand safety strains, stresses to which they shall normally be subjected to.
- vii) All fittings shall be of high quality and as specified and as per approval. The Contractor shall strictly follow, at all stages of work, the stipulations contained in the Indian Standard Safety Code or its Equivalent British
- viii) Standard and the provisions of the safety code and the provision of the safety rules as specified in the General Conditions of the Contract for ensuring safety of men and materials.
- ix) Any approval, instructions, permission, checking, review, etc., whatsoever by the Engineer-in-charge shall not relieve the Contractor of his responsibility and obligation regarding adequacy, correctness, completeness, safety, strength, quality, workmanship, etc.
- x) The fire check door shall satisfy:
- a. Stability: The fire check door should not collapse during the rated period of fire under the specified fire conditions. The fire check doors provide safe access to the escape route in the building namely protected corridors and staircase.
 - b. Integrity: The fire check door should not allow the passage of hot gases or the flame through the rebate or the gap between the door frame and shutters for the duration of its fire rating.
 - c. Insulation: The mean temperature of the fire door on the unexposed side should not exceed 140 degrees C above ambient temperature for the duration of its fire rating. The fire/smoke check door assembly being offered shall be as prototype tested by CBRI, Roorkee or any other approved laboratory for the prescribed fire rating as per BS:476 part 20/22, IS:3614 part-II. A test report from CBRI Roorkee / shall be submitted for approval before executing the work. The fire/smoke check door should also have Tariff Advisory Committee approval as admissible. The Bidder shall employ specialized agency or manufacturer of the fire check door assembly having their own manufacturing facility and such agency shall be got approved by the Engineer-in-charge. Door frame and shutters shall in general be fabricated as per the nomenclature of the item of the work and recommendation of the specialized agencies as approved by the Engineer-in-charge.
- xi) Fire check door shall be 2 hour or as specified fire rated and shall satisfy the three performance criteria of stability, integrity and insulation as per BS:476 part 20/22, IS:3614 part-II.
- xii) One door assembly shall be got tested from CBRI Roorkee / Bhubanewar or any other test laboratory approved by Engineer-in-charge as per the nomenclature of the item for the same.
- xiii) The Bidder shall be responsible for obtaining 'No Objection Clearance' from local fire authority for the executed work.
- xiv) Guarantee Bond: The work shall be guaranteed for a period of five years from the date of N.O.C. issued by the local fire authority. This security deposit against this item of work shall be in addition to the security deposit mentioned in schedule-F. The contractor shall execute the necessary

guarantee bond against any structural defect, faulty materials, workmanship and defective finish. In addition 5% (five percent) of the cost of this item of work shall be retained as security deposit and the amount so withheld would be released after five years from the date of completion of the entire work under the agreement, if performance of the work is found satisfactory. If any defect is noticed during the guarantee period, it shall be rectified by the contractor along with any incidental repairs to the structure, flooring, finishing, fixtures and any other related damaged work within fifteen days of receipt of intimation of such defects in the work. If the defects pointed out are not attended to within the specified period, the same shall be got done from another agency at the risk and cost of the contractor and the cost of attending such repairs shall be deducted from any dues payable to the contractor. However, the security deposit deducted may be released in full against bank guarantee or equivalent amount in favour of Engineer-in-charge in the prescribed proforma.

19.6. FIRE CHECK GLAZED DOORS & WINDOWS COMPOSITION OF THE DOORS & WINDOWS

- i) All materials, items, hardware etc. shall be subjected to approval by Engineer-In-Charge. Necessary documentation/ test certificates shall be furnished by the Contractor for such approval. FCD & FCW shall be fabricated only after approval of materials etc, by Engineer-In-Charge.
- ii) Each FCD & FCW shall be provided with a small metal identification plate in suitable location indicating Fire rating, name of the Manufacturer, date of installation and approval of approved test house.
- iii) Each vision panel shall carry a stamp of the manufacturer.
- iv) Unless otherwise mentioned elsewhere, all FCD & FCW shall be of two hours (120 Mins.) and all door assemblies (except fully glazed fire door) shall satisfy three criteria of fire resistance (stability, fire smoke check integrity and thermal insulation). For glazed fire rated door it should exhibit integrity, stability and radiation control for 120 mins and insulation for the first 15 mins. The glazed fire doors shall be manufactured as per the nomenclature of the item and as per the manufacturer's specification as per the best engineering practice and as per the drawing and direction of Engineer-in-charge.
- v) The glass panels shall be double glazed with thickness as specified clear, 120 min. rated, non wired toughened glass of approved make complies to BS476 Part 22 or (EN-1634-1:1999). The glass shall be complied to Class 1B1 Category of Impact Resistance to EN:12600 safety Glazing Material. The system should be tested as per EN:1364 Part-1-1999 or equivalent standard.

vi) INSTALLATION

Shop drawings of the doors, windows and partitions in accordance to the prototype profiles used to obtain fire test certificate by approved national or international test houses shall be prepared and submitted for approval by the Engineer-In-Charge. The shop drawings shall include all details of construction, anchoring, connections, fastening etc. Any suitable modification in fittings, fixtures as required for project specific installations shall have to be incorporated in door profile and approval obtained prior to the installation of the door.

vii) DELIVERABLES BY THE CONTRACTOR

Following documentation/drawings shall be furnished along with the Doors

- a) Prototype Test Certificate by international test house/ Exova/ Shop drawings
- b) specification / Manufacturer's literature, Test certificates and other documentation for materials and items intended to be used.

- c) Certificate indicating that design and installation of Doors and hardware conforms to norm laid down by approved international test house.
- d) Test report attested by Fire rated glass manufacturer.
- e) The Fire rated glass applicator has to be approved by Fire rated Glass
- f) Manufacturer and Submit the approved applicator certificate.

20. GLASS AND GLAZING WORK

20.1. GENERAL

A sensitive use of clear glass and glass with frosted 3M film shall be used in the interiors to admit natural light and give privacy to areas. All glass above 300mm x 300mm should be tempered/ toughened. Frameless glass used should be highly polished edges using CNC machines.

20.2. GLAZING

- i) The contractor shall furnish all labour, material and equipment required completing the installation of all glass and related items. A glass shall be of the type, quality, and substance specified in the schedule of quantities. The contractor shall cut glass sizes by field measurements or dimensions of the approved shop drawings. The responsibility for correct glass sizes shall rest with the contractor. No cracked, chipped or disfigured glass shall be accepted, and the contractor shall replace all breakages or faulty installation without extra cost.
- ii) The glass shall be set in wood or metal glazing straps and metal sash with elastic glazing and compound. The glass shall be beaded first and so installed as to achieve a completely watertight result. The opaque glass, where called for, shall be set with the smooth surface outside. At the completion of the work all glass shall be thoroughly cleaned off paint and other marks removed. No cracked, chipped or disfigured glass shall be accepted, and the contractor shall replace all breakage or faulty installation without extra cost to the owner before acceptance of fit-out.
- iii) All vision glasses shall be float glass of specified thickness. The edges shall be bevelled as indicated in drawings and shall be done at approved source.
- iv) The Etching wherever specified in drawings, shall be done at approved sources as per full-scale drawing approved by Engineer-in-charge / Project Manager. The etched panel shall be chemically washed /treated as per specialist specifications to have a permanent dust free surface.
- i. The Contractor shall be responsible for protecting all mirrors and glasses fixed by him and shall replace at his own expense any broken or damaged mirror / glass caused through lack of adequate protection or care in installation or handling.

20.3. TEMPERED / TOUGHENED GLASS:

- i) Tempered /Toughened glass shall be examined by the glass manufacturer to detect and discard any glass which exceeds the following tolerance: 1.5mm bow in 600mm; 3mm bow in 1500mm; 6mm bow in 3000mm; 9 mm bow in 4500mm. Where the strengthening process results in essentially parallel ripples or waves, the deviation from flatness at any peak shall not exceed 0.13 mm and the difference between adjacent peaks shall not exceed 0.13mm. Where bow tolerance and wave tolerance differ, the stricter requirements shall govern. Direction of ripples shall be consistent and in conformance with

architectural design.

- iii) Following test shall be also carried out by the contractor at his own cost as per following provisions.

Thickness	Impact Strength	Fragmentation	Surface	Bending Strength
IS-2835-1987	IS-2553-PART-I	IS-2553-PART-I	ASTM C-1048-90	DIN1249-PART- 12

20.4. FLOAT GLASS

- i) Glass that gives distorted reflections will not be accepted. Reflections due to pressure, paints poor manufacturing process, uneven thickness or poor storage are some of the reasons for distortion. All clear float glass quality should conform to BS – 952 and ASTM C 1036 – 90.

20.5. MIRRORS

- i) Mirrors shall be fabricated from best clear plate or float glass of approved quality in imported variety and shall match the International Standards. All fixed panel mirrors shall be +/- 0.30mm tolerance. The edges of mirrors shall be polished and beveled and mitered as per I.S. specifications wherever, it's indicated in the drawing.

20.6. LACQUERED GLASS

- i) Providing and fixing of 8mm thick annealed premium GRIHA rated lacquered glass of approved color by Architect/ Client /, fixed with compatible neutral core silicon / double sided tape on a perfectly leveled 12mm thick water proof plywood / MDF / Mineral fibre board which is mounted on the RCC wall/any other structure.
- Lacquered glass must be made industrially (via curtain coating process); opaque (if viewed against a support wall), coated with PU lacquer (25 micron thick);
 - color consistency (measured by Minolta spectrophotometer CM5081);
 - highly durable (passes PERSOZ hardness test for minimum 220 oscillations);
 - humid resistant (conforms to BS EN 1036 1999); environmentally friendly (no lead, no arsenic, no copper, no formaldehyde);
 - appropriate recycled content (12% post industrial / 6% post consumer); compressive strength (1000 MPa) & tensile strength (40 MPa), same as float glass;

20.7. GLASS RAILING:

- i) Fabrication, supply & installation of top mounted SS 316 grade glass railing made of SS top rail dia. 50 x 1.5 mm thk. mounted on SS baluster dia. 50 x 2 mm thk. with SS modular CNC made neck to hold the top rail as per drawing, height of the rail including top rail will be 800 mm from base plate lvl. Further the baluster will infill with 17.52 mm thk. (8 mm clear toughened + 1.52 PVB + 8 mm clear toughened) laminated glass of height 775 mm & length as per layout connected to the baluster with the help of CNC made modular glass holder as per drawing. Further the baluster will be top mounted with SS base plate of 100x100x8 mm thk. fixed on the RCC floor with M8 GI stud chemically grouted by using Mungo VIT 400. Baluster are spaced @ 1.2 mtr. regular intervals. All SS components are in SS 316 grade with satin finish, made by using modern, automatic machines like CNC machine, laser cutting, water jets

etc. The rate shall include cost & conveyance of materials, base plate screws, bolts, fabrication, any locking arrangements, transportation, cutting & making good the floor/walls, loading & unloading, handling of machineries all electrical charges etc. labour charges, all leads and lift etc. complete as directed by engineer in charge. (Please note that no welding of SS pipes will be allowed and work shall be done by a specialized agency on modular and component basis).

21. STRUCTURAL GLAZING

- i) This specification covers the general requirements of external façade work (Hard finishing and Aluminium glazing work) including engineering design involving structural stability of system as a whole, supply, fabrication, installation, testing, ensuring water tightness and maintenance etc.
- ii) Work under this section shall be performed by Specialized agency, who is regularly engaged in the engineering, fabrication, finishing and installation of glazing system including glazing and sealing of glass comparable to the volume of work in this project. The contractor shall submit full details and credentials of specialized agency for verification and to demonstrate to the satisfaction of the Engineer-in-charge that he has successfully performed comparable projects over the last three years ending 24.09.2015 as per the CPWD guidelines only after written approval of engineer in charge, the contractor will engage such specialized agency for this work.
- iii) Subcontracting any part of this work is specifically prohibited, except for that which may be approved by the Engineer-in-charge in writing prior to the award of the Contract.

21.1. SCOPE OF WORK

- i) The scope of work includes all labour, material, equipment and services as required for the complete design, engineering, testing, fabrication, assembly, delivery, anchorage, installation and water tightness of the glazing system. Anchorage includes all primary and secondary anchor assemblies and supportive structural framing as required for securing the glazing to the building structure. The scope of work also includes complete design, engineering, testing, fabrication, assembly, delivery, anchorage and installation of a suitable gondola/jib system for cleaning of the vertical glass and stone facade.
- ii) The contract documents define only the design intent and general performance requirements. The contractor is fully responsible for design, structural calculations, shop drawings, procurement of materials, fabrication, installation, warranties, certifications and related documentation. The entire work shall be carried out strictly in accordance with the true intent and meaning of the specification and drawings taken together regardless of whether the same may or may not be shown particularly on the drawings or described in the specification provided that the same can be reasonably inferred from there.
- iii) Only suggestive sizes and details are proposed by the Engineer-in-charge that have a visual impact on façade. Contractor's fabrication / shop drawing will seek these suggestions and design the final construction details.
- iv) The glazing shall be designed, fabricated at works, supplied, delivered and installed in accordance with the shop drawings and samples of materials approved by the Engineer-in-charge and shall be constructed to meet the performance requirements and standards.
- v) In general, the system should be designed to suit the aesthetics and performance requirements, taking into consideration the necessary factors

- to suit fabrication and the site conditions for erection.
- vi) Calculation of all wind loads applicable before designing the system
- vii) The contractor shall strictly follow, at all stages of work, the stipulations contained in the Indian standard safety code and the provisions of the safety rules for ensuring safety of men and material. The successful bidder shall submit a safety plan for approval of the Employer. On approval of the same, the same shall be followed during the currency of the contract.
- viii) The contractor must comply with all applicable local-building regulations and all the safety guidelines particularly specified for glazing work as per relevant I.S codes
- ix) Shop and field materials and workmanship shall be subject to inspection of the Engineer-in-charge and his authorized representative at all time. Such inspections do not relieve the contractor from obligations to provide materials conforming to all requirements of the contract documents and industry standards for material quality.
- x) All approvals, instructions, permission, checking, review etc. whatsoever by the Engineer-in-charge shall not relieve the contractor of his responsibility and obligation regarding adequacy, correctness, completeness, safety, strength, quality, workmanship etc. of the structural glazing system.
- xi) Testing will be done as per nomenclature of the item of typical DGU Panel of approved size in factory and in field through an approved testing agency. The testing charges for laboratory test will be paid by the department on successful test report as per actual.

21.2. SYSTEM DESCRIPTION

- i) The contractor shall devise a suitable framing system for vertical glazing application keeping in view the performance characteristics and aesthetics requirements.
- ii) The vertical structural glazing system shall be Semi unitized and shall be designed to suit sealed insulated glass units (hereafter referred to as "IG unit"). Aesthetically the design of the vertical glazing system shall provide a filtering envelope to the building and provide a uniform appearance. The glazing system shall have flush glazed exterior joints both horizontal and vertical. The structural glazing system shall be designed to receive fixed glazing as well as structurally glazed openable vents with protection of the glass edges. The contractor shall take adequate measures to ensure the thermal performance of the glazing system under the increased solar radiation prevalent in the region. No onsite sealant application will be permitted except for weather sealant in case of semi unitized system. The system shall comprise of factory prefabricated glazed vision and spandrel panels. The system should preferably permit re-glazing of vision panels from inside the building. Smaller dimension of mullion should not be more than 75mm. The contractor should choose a appropriate system also keeping in view the various requirements arising during future maintenance during the life span of the glazing system.
- iii) The structural glazing system shall be designed to allow for three- dimensional adjustments due to dead load, live load, wind load, seismic load and thermal movement. The framing system must be designed to provide adequate support for the IG units to prevent transfer of loads to the glazing below and to provide uniform support to both sides of the IG unit. Intermediate mullions should be of same size as that of outer mullions.
- iv) The structural aspects of the structural glazing system must be carefully integrated with the glazing rabbet and drainage details to ensure proper

performance. The structural glazing system shall be designed on the rain screen principle with provision for pressure equalization.

- v) The structural silicon sealant to be used in this structural glazing system shall be of such quality / designed to transfer wind, seismic, live and dead loads from the glass to the framed structure of the structural glazing.
- vi) The design shall incorporate floor-to-floor noise isolators, fire and smoke stops between the floor slabs and sill flashing etc. as per the NBC of India and also of the best international practices.

21.3. PERFORMANCEREQUIREMENTS

i) System design

The vertical glazing system and its components shall be designed to withstand dead loads and live loads caused by positive and negative wind loads acting normal to the plane of the glazing system. Design wind loads shall be 200KPa. The contractor to submit the design calculation and weight of aluminium per meter

- ii) The vertical glazing system shall also be designed to withstand seismic forces as calculated in accordance with I.S: 1893 (latest revision) under seismic zone V.
- iii) Apart from the above, the glass and the glazing system should also be designed to withstand a concentrated load of 100kg applied at any location so as to produce the maximum stresses in the glazing components. This load is envisaged to be encountered during cleaning of the glass facade.
- iv) The stress on structural sealant shall not exceed 20 psi under any circumstances. Thermal breaks shall be considered unable to transfer shear stress for composite action of flexural members. Assume elements joined by thermal breaks to act separately.

v) Deflection

- a. The deflection of any structural member in the plane normal to the glass surface when subjected to the specified loads shall not exceed $L/175$ of its clear span and shall be fully recoverable on withdrawal of the specified loads. Deflection of any framing member shall not exceed 19mm within any glass panel.
- b. Parallel to glazing plane, deflection of a framing member when carrying full design load shall not exceed an amount reducing the glazing unit bite below 75% of the design dimension. It shall also not reduce the edge clearance to less than 3mm nor shall it damage or impair the function of any joint seals.
- c. The deflection of the horizontal member due to the weight of the glass shall be limited to 3mm or 25% of the design edge clearance of the glass or panel below whichever is less.
- d. Twisting or rotation of the horizontal member under dead load of glass shall be limited to 1° by calculation from the horizontal plane.
- e. There shall be no in plane raking.
- f. In case either lite of the IG unit develops crack, the remaining lite should be capable of supporting the entire load. The overall strength and deflection behavior shall be calculated on the basis of the weakest lite.

ii. Systemassembly

The systemassemblyshouldaccommodatethe followingwithoutdamage tothe system,componentsordeteriorationof seals.

- a. Movementwithinthelensystem

- b. Movement between system and perimeter framing components.
- c. Dynamic loading and release of loads
- d. Deflection of structural support framing
- e. Tolerance of supporting components
- f. Shortening of building concrete structural columns
- g. Creep of concrete structural members
- h. Inter story drift
- i. A mid span slab edge deflection of 25mm
- j. Accommodate building construction tolerance of +30mm. These tolerances are not cumulative.

21.4. **WATER TIGHTNESS**

- i. Water penetration shall be defined as the appearance of uncontrolled water on inside face of any part of the structural glazing. No water leakage will be permitted when tested in accordance with ASTM E331. The test shall be carried out for duration of 15 minutes with a test pressure difference of 20 % of design pressure with a minimum differential of 137 N / mm² and a maximum of 575 N / mm². The minimum uniform water flow rate of 3.4L/m²/min.

21.5. **LABORATORY TESTS FOR WATER INFILTRATION**

TESTS FOR WATER INFILTRATION:

- i. **Static Pressure Test:** No water infiltration shall occur when the mock-up is tested in accordance with ASTM E-331 with the static pressure differential and the total time as specified.
- ii. **Dynamic Pressure Test:** No water infiltration shall occur when the mock-up is tested in accordance with AAMA 501.1 with the dynamic pressure differential and the total time as specified.

21.6. **FIELD MOCK - UP**

- i. In the presence of representatives of Owner, Engineer-in-charge, Contractor, Installer and Manufacturers, the Testing Agency shall conduct field tests on each of the installed Mock-Ups in accordance with methods described in AAMA 501.2 "Filed Check of Metal Curtain Walls for Water Leakage" using the loads specified in "performance Criteria".
 - a) Allow for several weeks notice prior to testing to allow for witnessing test.
- ii. Approximately 50% of each Field Mock-Up shall be field water tested.
 - b) All interior finishes including trim should be left off to allow for clear viewing.
- iii. **REMEDIAL WORK:** If the Field test of any Mock-Up reveals leakage, points of entry and paths of flow of water shall be identified, analyzed, and necessary remedial work shall be established, subject to Engineer-in-charge's / Employer's review and comment. Repairs and/or modifications shall be made to the entire mock-up based on these findings and, after adequate curing of all sealants, re-test to successful conclusion.
- iv. Re-testing after remedial work shall be from 50 percent to 80 percent of the mock-up at the Engineer-in-charge's recommendation. There test area designated does not necessarily have to be exactly the same as the original test area of the mock-up.

21.7. **METHOD STATEMENT FOR HOSE TESTING (ONSHORE) AT SITE:-**

- i. **STANDARD :-**

ii. **TEST AREA :-**

Area (s) to be tested will be selected by the Engineer-in-charge accordance with the standard. The total area will be not more than that can be tested in one day.

Testing shall be done at least one area of 100 square feet, in accordance with the test standard, or more, depending on the time, and availability of suitable access to the exterior. In case of failure the prescribed procedure for a reasonable time but not more than that can be completed on the same day shall be followed. The test will be supervised via two-way radio from the inside.

iii. **EQUIPMENT: -**

Testing equipment generally consists of the following and any other equipments as required for carrying out the test:-

- a) The 'Monarch' nozzle with pressure gauge and valve as prescribed by AAMA and recommended by CWCT.
- b) Two-way headset radio for communication between engineers and the people in the cradle.
- c) Other Requirements
 - (Optional) washing of the areas as recommended in Paragraph 7.4 of the CWCT Standard.
 - Visual checking of test area for snags, visible defects etc.
 - A cradle or scaffolding on the exterior at the locations (s) of the test specimen (s) with an operator, a person to stabilise the cradle, a person to hold and point the nozzle, technical person to communicate between the people on the exterior and test engineer.
 - Clean water in a minimum $\frac{3}{4}$ " supply hose with approximately 4 bar pressure. Note that the pressure given for the test is with the water flowing, much higher actual pressure is necessary. Water pressure drops 1 bar for every 10m rise in height.
 - Drying of test area and application and removal of tape if necessary to locate leaks.

21.8. **TEST CRITERIA:-**

- i. Water will be sprayed at a pressure of 30 -35 psi (2.07-2.41 Bar) in accordance with the test standard. The flow rate will not be monitored.
- ii. The nozzle will be held 30 cm. from the wall spraying 1.5m lengths back and forth along each joint, successively, for five minutes each, working from the bottom up. Joints are interfaces between materials, and where these are less than 120mm apart are to be considered one joint.

21.9. **TEST PROCEDURE**

- i. The initial area shall be the width of the cradle. The lowest horizontal joint will be wetted first, covering each 1.5m length in five minutes.
- ii. Next the cradle will be positioned so that the first 1.5m above the bottom horizontal joint can be reached and each vertical will be sprayed in turn over a period of 5 minutes.
- iii. The cradle will then be raised to test the next 1.5m and then the next horizontal and so on.

21.10. LEAKAGE

- i. If there is any leakage the test will be stopped and the procedure described in the Standard will be followed up to the time allowed.
- ii. A compliance report suggesting any modification / corrective steps to be taken if any leakage was observed.

21.11. AIR INFILTRATION

When tested in accordance with ASTM E283, air infiltration shall not exceed 0.03 l/s/sqm. Of wall area, measured at a reference differential pressure across an assembly of 200 Pa.

21.12. SYSTEM INTERNAL DRAINAGE

Drain water entering joints, condensation occurring in glazing channels, or route moisture occurring within the system to the exterior by a weep drain or network.

21.13. EXPANSION/CONTRACTION

The system shall provide for expansion and contraction within system components caused by a cyclical temperature range of 80°C over a 12 hour period without causing any detrimental effect to the system components.

21.14. GLASS PERFORMANCE DATA

The contractor shall furnish the following performance characteristics for the various laminated or IG (Insulated Glass) unit options all inclusive within his price:

Visible light transmission (VLT)	:	25% to 55%
Visible light reflection in	:	10% to 25%
Visible light reflection out	:	10% to 20%
U Value	:	2.5 to 3.3 W/m ² degree K

Contractor shall obtain final values on calculations from glass vendors and furnish the same.

21.15. TEST FOR STRUCTURAL PERFORMANCE

When tested in accordance with ASTM E330, the glazing system shall conform to the performance requirements.

21.16. SPECIAL INSTRUCTIONS

Vibration harmonics, wind whistles, noises caused by thermal movement, thermal movement transmitted to other building elements, loosening, weakening, or fracturing of attachments or components of the system will not be permitted.

21.17. HEAT SOAKING OF GLASS

- i. To minimize nickel sulphide (NiS) fractures at site heat soaking test is to be conducted within the factory.

- ii. Minimizing NiS fractures at site is mainly about making sure that fractures happen within the factory rather than at site after installation.
- iii. Heat soaking tempered glass is the most common form of ensuring that the chance of NiS infected panes leaving the factory are minimized.
- iv. The goal during heat soaking is to induce breakage at the factory to avoid on site breakage after installation.
- v. It is heat tempering of glass to 2800 C for 24 to 48 hours over temperature gradients to induce fracture.
- vi. Due to inherent safety and security benefits it is highly recommended for tempered glass to be heat-soaked in applications whose consequences of breakage are high.

21.18. INSULATED GLASS UNITS

- i. Providing, assembling and supplying vision glass panels (IGUs) comprising of hermetically-sealed 8-12- 6 mm insulated glass (double glazed) vision panel units of size and shape as required and specified, comprising of an outer heat strengthened float glass 8mm thick (Saint Gobain ET-425 or equivalent), of approved colour and shade with reflective soft coating on surface # 2 of approved colour and shade, an inner Heat strengthened clear float glass 6mm thick, spacer tube 12mm wide, dessicants, including primary seal and secondary seal (structural silicone sealant) etc. all complete for the required performances, as per the Architectural drawings, as per the approved shop drawings, as specified and as directed by the Engineer-in-Charge. The IGUs shall be assembled in the factory/ workshop of the glass processor. For payment, only the actual area of glass on face # 1 of the glass panels (excluding the areas of the grooves and weather silicon sealant) provided and fixed in position, shall be measured in sqm.
- ii. Coloured tinted float glass 8mm thick (Saint Gobain ET-425 or equivalent) substrate with reflective soft coating on face # 2, + 12mm Airgap + 6mm Heat Strengthened clear Glass of approved make having properties as visible Light transmittance (VLT) of 25 to 35 %, Light reflection internal 10 to 15%, light reflection external 10 to 20 %, shading coefficient (0.25- 0.28) and U value of 3.0 to 3.3 W/m2 degree K etc. The properties of performance glass shall be decided by technical sanctioning authority as per the site requirement.

21.19. SEALANT

- i. The insulated glass unit shall have poly-iso-butylene as primary sealant with low moisture vapour transmission rate and a structural silicone sealant for secondary seal.
- ii. The secondary edge sealant shall conform to ASTM C 1369-97. The contractor shall indicate the classification of the edge sealant as per clause 5.0 of the ASTM C 1369.
- iii. Structural flush glazed joints shall be a neutral cure high performance silicone sealant applied in accordance with the sealant manufacturer's instructions.

Color: Black

- iv. Weather seal joints shall be a neutral cure medium modules silicone sealant applied in accordance with the sealant manufacturer's instructions.

Color Black

- v. Unexposed, low movement flashing joints shall be non-drying, non-skimming, non-oxidizing, non-bleeding glazing sealant meeting MMA 8092
- vi. The sealant proposed by the contractor shall not bleed or stain under any

- circumstances. During the Bid stage itself, contractor shall identify the sealant to be used along with the structural glazing system and submit detailed technical parameters of the sealant by way of the sealant manufacturer's printed data sheets.
- vii. After award of the work, the Contractor will be responsible to carry out all the compatibility tests as listed below but not restricted to the following, with respect to the particular sealant from a laboratory approved by the Client / Consultant.
 - viii. The following tests shall be carried out with respect to the sealant:
 - a) ASTM C 794 Peel test
 - b) ASTM C1135 -Test method for determining Tensile-Adhesion Properties of elastomeric sealant
 - c) ASTM C-719 -Test method for adhesion and cohesion of elastomeric joint sealant under cyclic movement
 - d) ASTM C-1087 -Compatibility test between the proposed structural silicone sealant and the finished aluminium extrusions (mullions and transoms)
 - ix. For all sealant proposed to be used for this project, the contractor shall submit a letter of certification from the sealant manufacturer stating that the sealant has been tested for adhesion and compatibility on production of samples of metals, glass and other glazing components and that all sealant details and application procedures shown on the shop drawings are acceptable for use.
 - x. To prevent excessive shelf life and facilitate the correlation of batches of sealant with panel production, silicone sealant generally shall be used in the sequence of their manufacture.
 - xi. The structural glazing contractor shall obtain from the manufacturer and the supplier written confirmation of that the material has not been subjected to temperatures in excess of 27 degree centigrade between manufacture and delivery to the contractor's factory. The contractor shall store all silicone sealant at or below 27 degree centigrade up to the day of its application.
 - xii. Silicones which cure by different chemical reactions or which release different chemical by-products, e.g. acetic acid, alcohols, amines etc. during cure, should not come in contact to each other during fabrication, assembly and erection of the glazing system.
 - xiii. All adjoining surfaces not to receive sealants shall be protected against staining by masking tape.

21.20. OTHER MATERIALS

- i. The aluminium extrusions shall be 6063 alloy T6 temper conforming to ASTM B221 or equivalent. They shall be clean, straight, with sharply defined edges and free from distortion and defects impairing appearance, strength and durability. It shall be of suitable wall thickness and profile for strength with respect to tension, shear and bending stresses, capable of local and lateral stability.
- ii. Fixing bolts, screws and nuts, where in contact with aluminium, will be of stainless steel 304 grade.
- iii. Glazing tape for structural glazing shall be Norton or approved equivalent.
- iv. All dissimilar metal surfaces shall be isolated to prevent anti galvanic action. Materials used for this purpose shall be non absorptive. Metal

surfaces shall be separated in such a manner that metal does not move on metal.

- v. Aluminium surface in contact with mortar, concrete fireproofing, plaster, masonry and absorptive materials shall be coated with anti-galvanic moisture-barrier material and nothing extra will be paid for this.

21.21. ACCESSORIES

- i. Extruded gaskets, weather stripping, extruded seals and spacers which do not come into contact with structural silicone sealant shall be of ethylene propylene diene monomer (EPDM). Where in parallel contact with structural silicone sealant, all gaskets, setting blocks and spacers other than foam glazing tapes shall be of heat-cured silicone rubber, chemically compatible with the silicone sealant and suitable for the specific purpose intended. All extruded gaskets, weather stripping and spacers other than foam glazing tapes shall have continuous mechanical engagement to framing members; any adhesive attachment is not acceptable. Unless otherwise approved, gaskets, weather stripping, extruded seals and spacers shall have a hardness of 40+5 durometer Shore A.
- ii. The cladding system shall be constructed with (and shall maintain during its design life) a standard of seal which shall not result in any reduction of sound insulation performance.
- iii. Gaskets, weather stripping and seals used to achieve the required weatherproofing and/or air tightness shall be selected to accommodate fully the range of dimensional tolerances associated with fabrication and installation of the cladding system. Gaskets, weather stripping and seals shall be formed from materials capable of retaining their elastic qualities, dimensions and resistance to physical and chemical attack sufficient to maintain the full water tightness, air tightness and acoustic performance for the design life of the structural glazing system.
- iv. Extruded gaskets, weather stripping, seals and spacers mechanically engaged by flutes or pockets extruded in framing member shall be installed without residual tension or extension. Dry lubricants may be used to reduce drag during installation of synthetic rubber extrusions and to induce compression so as to prevent gradual elastic shrinkage and retraction from their ends. Wet lubricants containing detergent shall not be used in any location from which spillage onto glass and aluminum surfaces cannot be immediately and completely removed at the factory. Concentrated detergents shall not be used for any purpose which may bring the liquid into contact with the coated surfaces of vision and spandrel glass.
- v. Setting blocks shall be dense heat-cured silicone rubber with a hardness of 80 to 90 durometer Shore A. Side blocks and anti-walking blocks shall be dense heat-cured silicone rubber with a hardness of 60 to 70 durometer Shore A

21.22. FLASHING

- i. To prevent leakage, flashing shall be formed from either stainless steel or aluminum or sheer neoprene of 1.5mm thickness with joints tapped and sealed 150mm minimum.
- ii. Flashing shall be provided on all sides of glazing where external glazing terminates and wherever else required to provide a completely

watertight installation. Wherever visible, it shall have the matching finish of Aluminum.

21.23. COLUMN CLOSERS

- i. The Contractor shall supply and install suitable closer section to seal up the gap between columns and / or walls, which abuts the line of the external glazing.
- ii. The principal function of the closer piece shall be to provide a neat connection with the external glazing as well as a means of cutting off stray artificial light from the outer face of the column / wall.
- iii. The column closer shall be installed in such a way as to provide a flexible connection to allow for tolerances, building I external glazing movements and dimensional differences between the external glazing and the column and / or wall face.
- iv. The column closer shall also be designed in such a way as to allow the following:
 - a. Easy removal for maintenance.
 - b. Installation after finishes are applied to the column / wall.
 - c. Easy removal of internal glazing units for cleaning / maintenance replacement.
 - d. Compatibility with the requirements of the fire safety requirements.

21.24. THERMALINSULATION

- i. Thermal insulation shall be provided in all spandrel areas without fail.
- ii. Insulation shall be provided using fasteners of the type and spacing recommended by the insulation manufacturer.
- iii. The thermal insulation in spandrel panel shall be 50mm thick chemically inert semi-rigid black faced fiberglass wool batts with a density of 48 Kg/Cum. conforming to IS: 8183 / BS: 3958. Insulation within every spandrel panel shall consist of a single panel of mineral wool or fiberglass without butt joints.
- iv. The Contractor shall replace any damaged or wetted insulation material when so instructed by the Employer.

21.25. FIRE STOP

- i. At each floor edge the required fire protection is to be maintained between elements of structure by using fire stop insulation to give a minimum of 2 hours fire protection between floors including in front of columns or blank walls. The fire stop material is to be installed to completely seal up the void between the face of the structure and the glazing and shall fully comply with local Codes and Regulations.
- ii.
- iii. The fire stop material must be flexible to allow movement between the structure and the external glazing.
- iv. The fire stop material shall be located and held in position in such a way so as to ensure integrity of the fire protection as well as preventing accidental damage or loss of materials.
- v. The Contractor is required to provide full details of all fire stop material including fire test certificates and confirmation of local Fire Service Bureau approved material status. Shop drawings shall also be submitted for approval showing the full details of fire stops.

21.26. FINISHES

- i. All exposed framing members shall be free of scratches and other blemishes. All aluminum surfaces shall be electrostatic powder coated in stainless steel colour or as approved by the Engineer-in-charge. The anodic coating shall conform to IS:1868 -1968 / IS- 5523:1983 and shall be of AC25 grade with minimum thickness of 20 microns when measured as per IS: 660/2-1970 and density shall be at least 32 Mg/sqm. The anodic coating shall be tested in an approved laboratory by eddy current method as per IS:6012 for thickness. Sulphuric acid shall be used as the electrolyte for the anodic process. Prior to anodizing, all aluminium shall be rendered uniform in appearance free from disfiguring scratches, stains or other blemishes and etched in caustic soda solution. Requisite tests shall also be carried out at the site as required by the Employer and the contractor shall arrange all assistance and equipment required for the purpose.

21.27. PROGRAMME OF WORK

The contractor shall submit a detailed program of work along with time schedule indicating the various items of work pertaining to the structural glazing work as below:

- i. Design and approval
- ii. Shop drawings
- iii. Submission of samples
- iv. Mock-up
- v. Test reports
- vi. Material co-ordination, ordering and delivery
- vii. Fabrication
- viii. Installation
- ix. Inspection and remedial measures.

21.28. DESIGN CALCULATIONS

- i. The contractor shall be responsible for the design of the structural glazing system including all its various components like glass, sealant, framing system, gaskets, fixing and anchorages proposed by respective specialists. The contractor shall submit structural design calculations prepared in accordance with relevant Indian/International codes and standards as applicable. The design shall be carried out under the direct supervision of a professional engineer experienced in design of this type of work and licensed at the place where the project is located. Structural design shall include, but not limited to, computations for the justification of external glazing sections and connections including fasteners, welds and anchorage assemblies.
- ii. The contractor shall submit for Engineer-in-charge's approval all structural calculations with reference to structural properties and physical characteristics and dimensional limitations of the framing members of the glazing system. The contractor shall also submit design calculations for all connections, the dimensions of all extrusions and complete data of all alloys proposed to be used for the project.
- iii. Approval of structural calculations shall not relieve the contractor from any of the responsibilities and requirements specified therein.
- iv. The contractor shall submit the glass manufacturer's wind pressure analysis, seismic load analysis and thermal analysis showing that the

specified maximum deflections and probabilities of breakage are not exceeded.

21.29. SHOPDRAWINGS

- i. The contractor shall submit shop drawings showing clearly the relationship of the structural glazing facade to the building structure, mechanical and electrical systems, floor slabs and any other related works. They shall show the arrangement of components, instructions and explanatory details for the sequence of fabrication, assembly, erection and installation of all materials including the glass and de-glazing procedures. They shall include the following:
 - a) Plan, elevation and details required to fully describe the structural glazing system.
 - b) System dimensions framed opening requirements and tolerances for squareness, corner offset and bows.
 - c) Dimensional position of glass edge/face relative to the aluminium framing, full size junction details between mullion and transom and end details.
 - d) Isometric drawings of flashing, joints between transom and mullions, end details etc.
 - e) Expansion and contraction joint location and details
 - f) Weep and condensation drainage network
 - g) Full size details including isometric drawing of sealing, flashing and jointing Methods
 - h) Materials, type, size, location, spacing of all screws, bolts, weld, anchoring devices and all accessories.
 - i) Die drawings for all gaskets, extrusions
 - j) Relationship of edge members with architectural stone/ wall finish and flashing at joints.
- ii. The contractor shall submit a fully detailed program for the presentation of shop drawings to the Engineer-in-charge for approval, and in no case shall the contractor proceed with any of these works without approved shop drawings.
- iii. The contractor shall review and submit all shop drawings in a sequence consistent with the sequence of erection, installation and assembly of the various elements of the work. He shall be deemed to have determined and verified all materials, site measurements and construction criteria related thereto and to have checked the shop drawings for complete dimensional accuracy.
- iv. Any approval by the Engineer-in-charge of the shop drawings shall not relieve the contractor of his responsibility for any deviation from the requirements of the contract unless he has specifically informed the engineer in writing of such deviation at the time of submission and the Engineer-in-charge has given written approval to the specific deviation.

21.30. SAMPLES

- i. The contractor shall submit all samples at his own cost. Samples shall

be submitted for approval well in advance of the date, on which the particular work involving the use of materials for which samples are submitted, is scheduled to begin.

- ii. The work shall be carried out in accordance with the approved samples. The following shall be submitted:
 - a) 2 samples of 600mm x 600mm in size illustrating pre-coated aluminium mullion and transom junction detail complete with glass skin and glazing materials illustrating edge and corner.
 - b) 4 nos. 12" x 12" samples of each type of glass.
 - c) 4 nos. 6" long samples of principal extrusions.
 - d) 4 nos. manufacturer's samples of each type of aluminium finish.
 - e) 4 nos. manufacturer's samples of each type of sealant
 - f) 2 nos. manufacturer's samples of all accessories and hardware envisaged to be used for the structural glazing system.

21.31. MOCKUP

- i. The contractor shall construct a mockup including intermediate and edge mullion, vision and spandrel panel. The mockup should illustrate component assembly including framing, glass, glazing materials, weep drainage system, attachments, anchors and perimeter sealant.
- ii. Location for mockup will be at site approved in advance. Mockup will not remain as part of the work.

21.32. TEST REPORTS

- i. The contractor shall arrange for all testing required with regard to this work at his own cost, at such test laboratories in India or abroad as approved by the Engineer-in-charge. Apart from the tests carried out, the contractor shall substantiate engineering data and provide test results of previous tests, which purport to meet performance criteria and any other supportive data.

21.33. SOURCES

The contractor shall submit the name of the suppliers for the following items of work along with the shop drawings and samples.

- a) All components of the structural glazing system
- b) Aluminium extrusions
- c) Anodizing paint from manufacturer authorized applicator
- d) Sealant
- e) Glass
- f) Hardware
- g) Gaskets
- h) Fasteners
- i) Anchorages

21.34. SUBMITTALS

The contractor shall submit 4(four) copies of the following documents

pertaining to the engineering of the structural glazing using structural glazing system to the engineer for approval, review etc.

- a) Shop drawings
- b) Structural design calculations for aluminium framing, glass thickness and sealant by size as per clause 6.1
- c) Calculations for deflection as per clause 6.2
- d) Test reports as per the performance requirements vide clause 13.0
- e) Special installation requirements, special procedures, safety precautions and perimeter conditions requiring special attention as stated by the manufacturer.
- f) Samples vide clause 11.0
- g) As-built drawings
- h) Maintenance manual upon completion of the project.

21.35. ORDERING AND DELIVERY

Before commencement of any fabrication or ordering of any materials, goods or works, the contractor shall be required to submit for the Consultant's approval shop drawings, samples etc. of all relevant details as to materials, sizes, manufacturer's printed specifications and all other details and information as desired by the Consultant.

Mockup shall have to be approved by the Employer / Consultant engineer before placing final order for delivery of the approved products.

21.36. PRODUCT HANDLING

Handling of glass and aluminium frame, to be incorporated in to the structural glazing system, shall be done with utmost care to avoid any damage or surface scratch. Field cutting of anodized components shall not be permitted.

The glazing contractor shall submit Method statement for handling various materials within two weeks of signing this contract to the Employer / Consultant.

21.37. LIGHTNING PROTECTION:

Each complete frame shall be provided with a single bolt, to which the bonding conductor may be connected by the electrical contractor on site. The bolt shall be high tensile, size MB stainless steel, and shall be securely fastened to and in sound electrical connection with the frame. The bolt shall be supplied with two plain washers and locking washers and nuts, by which the bonding conductor will be connected to the bolt. The bolt shall be supplied and fixed at your works before delivery to site. The electrical connections from bolts which are to be supplied by you including the lightning protection devices, inspection openings for test lamps, etc.

21.38. SITE MANAGEMENT

Specific to this project the following project management roles have to be provided as a minimum by the successful bidder.

- a) Project Engineer -Full time responsibility for the project with a cell

- phone provided for easy access & communications.
- b) Design Manager -Responsible for the design and engineering
- c) development of the project.
- d) Installation Manager- Day-to-day responsibility for access equipment, scheduling and site installation. He should also have mobile phone with him for communication.
- e) Quality assurance engineer -Responsible for implementation of project's quality plan
- f) Team leaders -Site team leaders heading each of the installation
- g) teams.
- h) All key individuals should have been fully trained by the Contractor for their tasks.

21.39. FABRICATION&INSTALLATION

The Structural glazing wall shall be fabricated, glazed and installed by experienced workmen having specialized skill in structural glazing and strictly in accordance with the approved shop drawings.

All welding shall be done by the heliarc process and all exposed welds ground to minimum 100 grit finish.

21.40. PROTECTION

- i. The contractor shall be responsible for all materials against damage from mechanical abuse and foreign matter during installation. A layer of clear transparent laquer based methacrylates or cellulose butyrate shall be applied on anodized members before they are brought to site. The laquer shall be removed on completion of erection.
- ii. On virtual completion and receiving instruction from the Engineer, the Contractor shall remove all protective coverings, manufacturer's seals, labels etc. The contractor shall thoroughly clear the internal and external glazing area and members with cleaning solution recommended by the respective manufacturers.
- iii. The Contractor shall ensure that the highest possible standards of material protection are maintained both in the fabrication and installation of the external glazing system.
- iv. The Contractor shall ensure that all materials and completed panels are delivered to site without damage and that all components are fully protected. In this respect a method statement will be required describing the protection measures to be adopted when transporting material to site and hoisting it into the floors for final installation.
- v. Panels awaiting installation are to be stacked on pallets to a height to be stored separately on site for possible fabrication in-situ.
- vi. As stated elsewhere, it is intended that as much as possible the fabrication shall be carried out off site in the shop. Wherever this is not feasible for whatever reason the Contractor is required to submit details of in-situ work for approval by the Employer.
- vii. All materials stored at site are to be protected in such a manner as to prevent damage from falling objects, dust, water and dirt. The material must be safe from mishandling or damage by any contractor I agency I sub-agency either in the pursuit or their own works or by their personnel.
- viii. During installation, the Contractor shall provide protection to the external glazing to prevent the ingress of water from either rain or any

other reasons. This protection shall be strong enough to withstand adverse wind conditions, and shall provide complete protection at the top level of the installation necessary to prevent the ingress of water into or behind the cladding.

- ix. The external glazing shall be screened from weld splatter, spray-on fire proofing, concrete, alkaline masonry washes, paint and other deleterious substances. Any such soiling shall be promptly and completely removed. The design of protective screening shall be such as to provide adequate ventilation of the space between the glass and the protective screen and not induce thermal stresses in the glass. In no case shall the protective screening be placed in contact with the glass.
- x. The Contractor shall provide at each completed floor an internal protection of 1000 gauge heavy Polyethylene sheet suspended from the top of the external glazing at slab soffit and extending to the floor. These drop sheets must be maintained until all wet trades are completed on each floor.
- xi. The fixing method for sheets is to be indicated in shop drawings and a sample approved by the Consultant / Employer.

21.41. CLEANING

- i. The Contractor shall ensure that all actions are taken during installation to eliminate the effects of corrosive substances on the finishes of the external glazing.
- ii. The Contractor shall clean both internal and external surfaces to remove corrosive substances, dust or cement / mortar dropping during the installation as may be directed and instructed by Engineer-in-charge.
- iii. The internal surfaces of glass and aluminium frame are to be cleaned with compatible cleaning agents prior to the installation of the internal protective sheeting.
- iv. The Contractor shall provide written verification that cleaning agents are compatible with aluminium, stainless steel, glass coatings, granite, glazing materials and sealants. In no case shall alkaline or abrasive agent be used to clean the surface. Care shall be taken during cleaning to avoid scratching of the surface by dirt particles.
- v. Prior to snagging inspections the Contractor shall remove the internal protection sheets and carry out a thorough cleaning of all glass, aluminium and spandrel panels as per the direction of Engineer-in-charge.
- vi. The protective sheeting shall then be removed permanently provided that no other wet works or services work are required in the immediate vicinity of the external glazing.
- vii. The Contractor shall also make good any physical drainage to the wall including scratches, dents, abrasions, pittings, etc., to the satisfaction of the Engineer-in-charge / Engineer.
- viii. Manufacturer's delivery or job marking on glass and adhesive for manufacturers cables shall be either a neutral or slightly acidic material and in no case shall such material be alkaline. Any staining of glass by alkaline material will be cause to rejection of the glass.
- ix. After the installation of each panel of glass all markings and labels shall be carefully and completely removed from the panes. Thereafter no markings or labels of any sort shall be placed on the glass.
- x. Glazed openings shall be identified by suitable warning tapes or flags attached with a non-staining adhesive or other suitable means to the framing of the opening. Tapes or flags shall not be in contact with glass.

- xi. Prior to the handing over of each floor to the Engineer-in-charge, the Contractor shall carry out a final cleaning of the external glazing.
- xii. As soon as it is practically possible after the issuance of the occupation period for the building, the Contractor shall carry out a complete cleaning of the external face of the external glazing.

21.42. REMOVAL OF IMPROPER WORK AND MATERIALS

Any materials/or works which, in the opinion of the Employer, are not in accordance with the specification, shop drawings and instructions shall be removed from the site immediately.

21.43. REJECTION

If, at the time and place agreed in accordance with sub clause (Removal of improper work and materials), the materials are not ready for inspection or testing or if, as a result of the inspection or testing referred to in this clause, the Engineer-in-charge determines that the materials are defective or otherwise not in accordance with the contract, he may reject the materials and shall notify the contractor immediately. The contractor shall then make promptly make good the defect or ensure that rejected materials comply with the contract. If the engineer so requests, the tests, on rejected materials shall be made or repeated under the same terms and conditions. All costs incurred by the engineer by the repetition of the tests shall be recoverable from the contractor by the engineer and may be deducted from any monies due or to become due to the contractor.

21.44. PERFORMANCE GUARANTEE

- i. The contractor shall be solely responsible for the design including shop drawings and performance of the installed structure glazing system, aluminium composite panel cladding and louvers, sky lights, structurally glazed aluminium windows/doors, fully glazed fixed partitions, frameless fully glazed doors with patch fittings etc. The installations shall be guaranteed by the contractor during the guarantee period for materials used, workmanship, water tightness (wherever specified), structural design, performance requirements and other requirements as given in the specifications. The contractor shall submit in the enclosed format a written guarantee for the same for a period of 10 years from the date of completion of the work. In addition, the contractor shall obtain and submit to the Engineer-in-Charge a similar back-to-back guarantee for same duration from the specialist agency / structure glazing fabricator engaged by them.
- ii. The design, fabrication, supply and installation of the system shall be to the best of national / international standards and shall be guaranteed to take the dead loads, wind and seismic loads, storms, air pollution, thermal stresses, building movements and the consequent deflections without compromising the performance characteristics. It shall be water tight, wherever specified and prevent ingress of water/ moisture, pollutants etc. Further, the individual members of the structural framing shall not deflect beyond permissible limits as specified.
- iii. In addition, guarantee for 10 years for all the material used and their performances shall be submitted by the contractor. Besides, the contractor shall obtain and submit similar back to back guarantees from the specialist agency / structural glazing fabricator and also from the

manufacturers/suppliers/processors, as applicable, of various material to the tune that they conform to the specifications and other criteria as specified herein for:

- a) Glass (Single, laminated or DGUs) – substrate, coatings, lamination, assembly of DGUs etc. and that regarding suitability of single soft coated glass in the spandrels.
 - b) Sealants – usage as per requirement of structural design and functional requirements, compatibility with different substrates and sealants, bite size, quality assurance during sealing of DGUs and fixing glass to glass and glass to the aluminium frame, etc.
 - c) EPDM / Silicone gasket – for ozone resistance and other properties as specified etc.
 - d) Aluminium – material quality, tempering requirement, suitability of aluminium grade and anodizing etc.
 - e) Anchor fasteners – suitability and strength requirement as per manufacturers' specifications etc.
 - f) Aluminium composite panel cladding – Material quality and PVDF coating etc.,
- iv. The contractor shall also submit guarantee in the enclosed format for replacement of glass during the guarantee period of 10 years from the date of completion of work. All the Guarantees shall be submitted before final payment is released after the date of the completion of work and shall not in any way limit any other rights, which the Engineer-in-Charge may have under the Contract.
- v. In addition 2% (two percent) of the cost of all the items under this sub-head, as mentioned in the scope of work under para (1) above (structure glazing system, aluminium composite panel cladding and louvers, sky lights, structurally glazed aluminium windows/doors, fully glazed fixed partitions, frameless fully glazed doors with patch fittings etc.,) shall be withheld from the bills towards guarantee as specified above. This amount to be withheld towards guarantee shall be in addition to the other amounts to be withheld as mentioned elsewhere in the contract agreement. However, half of this amount (withheld) would be released after five years from the date of completion of the work, if the performance, as required, is satisfactory. The remaining withheld amount shall be released after 10 years from the date of completion of work, if the performance, as required, is satisfactory. If any defect is noticed during the guarantee period, it shall be rectified by the contractor within seven days of issue of notice to the contractor, at least temporarily, to the satisfaction of the Engineer-in-Charge, till the permanent rectification of the defects / replacement of defective materials is carried out by the contractor, in maximum four months period. If not attended to, the same shall be got done by the Engineer-in-Charge through other agency at the risk and cost of the contractor and the cost, which shall be final and binding on the contractor, shall be recovered from the amount withheld towards the guarantee as mentioned above or any other amount due to the contractor. In any case, during the guarantee period, the contractor along with specialist agency/ curtain wall fabricator shall inspect and examine the work at least once in every year and make good any defects observed. The contractor shall submit a written certificate in this regard. A recovery of Rs. 10,000/- per year shall be made from the amount, withheld towards guarantee or any other amount due to the contractor, in event of not fulfilling this provision. However, the amount withheld as guarantee can be released

in full, if irrevocable bank guarantee, from a Schedule / Nationalized Banks, of the same amount, for the guarantee period is submitted by the contractor to the Engineer-in-Charge. The defects, if any, shall be rectified in a workmanlike manner, retaining the same aesthetics and other functional parameters of the original work.

21.45. MAINTENANCE MANUAL

- i. On completion of the works, The contractor shall prepare a detailed maintenance manual for the structural glazing system. The manual should cover the following:
 - a) Complete and detailed explanation of operating principles of the structural glazing system
 - b) Description of all the various components of the glazing system,
 - c) Recommended Inspection schedule and periodic inspection procedure,
 - d) Complete parts list,
 - e) Instructions for proper cleaning procedures and routine maintenance of the facade including frequency,
 - f) Cleaning products and their source
 - g) Method statement for re-glazing and replacement of component parts with appropriate drawings;
- ii. Four copies of the maintenance manual must be handed over to the CPWD within four weeks from actual completion of work.
- iii. Particular specifications for sanitary installations, water supply & drainage

21.46. GENERAL

- i. The work under this sub-head in general shall be carried out as per the PIU/ Relevant Specification/ Relevant Codes/ Relevant Circular/ CPWDs, as per architectural drawings and as per directions of Engineer-in-Charge.
- ii. Before taking up the work, the contractor shall prepare integrated shop drawings showing details of various pipe lines running horizontally and vertically and obtain approval of Engineer-in-Charge. Integrated services drawings shall conform to local byelaws. The work shall be carried out as per approved integrated shop drawings for sanitary installations, water supply, rain water and drainage pipes.
- iii. Samples of all the pipes, fittings, fixtures etc., of make as per the list of approved materials shall be brought to site, well in advance, prior to start of any of the works and got approved by the Engineer-in-charge.
- iv. Two sample toilets with all the pipelines, fittings and fixtures shall be prepared and tested for proper functioning of the system and got approved from the Engineer-in-charge before taking up mass work. The sample toilet(s) shall form part of the main work if the performance is found satisfactory; otherwise, the same shall be dismantled and redone by the contractor at his cost.
- v. The chasing, cutting and making holes in the masonry and / or cement concrete and / or RCC works shall be done carefully without causing any damage to the structure. As far as possible, mechanical cutters & core cutting machines shall be used in a workman like manner, for concealing the pipelines and fittings. The chases / holes, so made, shall be made good with the cement mortar of mix 1: 4 (1 cement: 4 coarse sand) after testing of the pipe lines for leakage. The cost of cutting cores in RCC, cutting holes in masonry & making good the same shall be inclusive in the respective item of drainage/ water supply lines.
- vi. All vertical sanitary & GI pipes shall be fixed to hot dipped galvanized M.S

supporting frame with “U” shaped G.I bolts, threaded at both ends, as specified, with GI nuts, GI washers, GI cleats etc. as approved by the Engineer-in-charge. Supporting frame shall be fixed with approved anchor fasteners as directed by the Engineer-in-charge. In all cases, pipelines shall be fixed, minimum 50 mm away from the finished wall face and shall not be fixed directly to the walls. The cost of providing and fixing GI supporting frame, “U” bolts, GI nuts, GI cleats, anchor fastener etc., for clamping the pipes to the supporting frame shall be paid for separately under relevant items.

- vii. All horizontal pipes shall be fixed to the soffit of beams / slabs etc. with G.I. hanger rods & G.I. frame work as per the approved shop drawings and as directed by the Engineer-in-charge. The pipelines shall be clamped to the structural steel frame work with “U” bolts and nuts, washers, cleats etc., of length and diameter as required and as specified. The G.I. frame work, hanger rods, anchor fasteners and U bolts shall be paid for separately under relevant items.
- viii. Water supply pipes on the terrace shall be fixed to the walls with GI clamps or by supporting on masonry / plain cement concrete piers cast on slabs as approved by the Engineer-in-charge. The cost for providing and fixing G.I. clamps & Plain cement concrete piers etc. shall be included in the cost of water supply pipe.
- ix. The contractor shall sequence the activities for external drainage and other pipe lines work in such a way that no hindrance is caused to other activities like laying of external electrical cable, development, landscape and road work etc.

22. FINISHING (PAINT)

22.1. GENERAL

- i. The work shall be done in accordance with PIU/ Relevant Specification/Relevant Codes/ Relevant Circular/CPWDs - 2009 Vol. I to Vol. II with upto date correction slips and the manufacturer's specifications where PIU/ Relevant Specification/Relevant Codes/ Relevant Circular/CPWDs are not available.
- ii. The quantity of paint required as per the theoretical consumption including wastages, if any, shall be procured from the approved manufacturer or his authorized dealers and deposited with the representative of the Engineer-in-Charge at site.
- iii. The paint shall be obtained in smaller packing (around 20 litre).
- iv. The paint shall be kept in the joint custody of the Department and the Contractor and day- to-day account of receipt and issue shall be maintained. However, the safe custody and watch and ward shall remain to be the responsibility of the Contractor. Nothing extra shall be payable on this account.
 - a) The name of the manufacturer, manufacturer's product identification, manufacturer's mixing instructions, warnings and instructions for handling and application, toxicity and date of manufacturing and shelf life shall be clearly and legibly mentioned on the label of each container. These details shall be kept in record. The material shall be consumed in the order of material brought to site, first come first consume basis. The Contractor shall obtain and submit to the Department the manufacturer's certificate for compliance of the various characteristics of the materials as per the manufacturer's specifications and also copy of the manufacturer's test report for the record.

- b) Empty containers of the paint shall not be removed from site till the completion of the work unless otherwise permitted and shall be removed only with the permission of the Engineer-in-Charge or his authorized representative at site of work.
- c) All arrangements for measuring, dosing etc. at site shall be made by the Contractor. Nothing extra shall be payable on this account.
- d) The Contractor shall apply samples of each kind of paint for the approval of shade and colour as per the direction of the Engineer-in-Charge before procuring the paint in mass.
- e) All incidental charges of cartage, storage, wastage, safe custody, scaffolding, cost of samples and mockup etc. shall be borne by the Contractor and no claim, whatsoever, shall be entertained on this account.
- f) For the item of Epoxy paint, it is clarified that the surface for painting shall be prepared by shot blasting. The metal surfaces shall be cleaned of any rust using sand/emery paper and also by mechanical brush/power tool cleaning using grinder as required as per the manufacturer's specification etc. The sand blasting gas such is not required to be carried out on the surface. However the epoxy primers shall be applied immediately after the surface preparation.
- g) For the item of melamine polish, the item includes all the sand papering required to be carried out and wiped properly for cleaning all the loose dust particles. Necessary masking tapes are to be provided where different finishing work is to be carried out, so that the melamine polish does not spread to the other surfaces. Care should be taken while removing the masking tape, so that the surface is not damaged. Cost of melamine polish includes the cost of providing and removing the masking tapes wherever required. The surfaces shall be sandpapered using emery paper no. 180, 320 and 400 as required. Any staining required shall be carried out by applying Apcolite Wood Stain or equivalent, to achieve the required colour and shade as directed by the Engineer-in-Charge. The item of melamine polish is deemed to include cost of such staining. Where French spirit polish is to be carried out the rate is inclusive of cost of staining and wood filler (Apcolite wood filler of Asian Paints or Asian NCC Clear Wood filler or equivalent of other brands ICI and Pidilite Industries) if required. Nothing extra shall be payable on this account.

22.2. QUALITY ASSURANCE

For Quality Assurance the Contractor shall ensure that color and texture of finish coats, shall match the approved sample. Also,

- i. Color of priming coat shall be lighter than body coat.
- ii. Color of body coat shall be lighter than finish coat.
- iii. Color prime and body coats as required so as not to show through the finish coat and to mask surface imperfections.

Before starting application of each type of paint, the Contractor shall apply the paint to a specimen area, not to exceed 10 square meter and get finish and texture approved and shall use it as a sample for the remainder of the work.

23. STAINLESS STEEL HANDRAIL

- i. Providing, fabricating and fixing in position welded built up section

using stainless steel section/pipes and connecting plates, of Grade S.S 316 and of required diameter & thickness as per the detailed drawings and details, at the junction of doors, on walls, other locations as directed etc. including cutting, welding, grinding, bending to required profile and shape, finish, hoisting, buffing and polishing, cutting, chase/ embedding in RCC/Masonry, fixing using stainless steel screws, nuts, bolts and washers or stainless steel fasteners as required to make it rigidly fixed & stable and making good the plaster/ flooring etc. all complete, at all floors and all levels as directed by the Engineer-in-Charge. Prototype sample to be approved by Engineer-in-charge before mass fabrication.

- ii. Rate includes cost of all input of materials, labour, T&P, etc. involved in the work and all incidental charges to execute this item. However, for the purpose of payment only the actual weight of the stainless pipes and stainless steel plates provided and fixed shall be measured in kg.

24. PARTICULAR SPECIFICATION AND ADDITIONAL CONDITIONS FOR WATERPROOFING WORK

24.1. WATERPROOFING TREATMENT

- i. All the water proofing treatment shall be got executed as per PIU/ Relevant Specification/ Relevant Codes/ Relevant Circular/ CPWD and as per the manufacturer's specification through one of the specialized agencies as per the direction of Engineer-in-charge list of approved agencies attached with the Bid. The water proofing agency shall carry out water proofing work with one of the approved water proofing compound mentioned in the Bid. If so specifically requested by the contractor, he will be allowed to use other water proofing compound meeting various technical parameters, subject to prior approval of Engineer-in-Charge.
- ii. The contractor shall furnish the following particulars immediately after the issue of letter of acceptance by the Department.
 - a. The name of the specialized firm.
 - b. The trade names of the product, which would be used.
 - c. List of works where the treatment has been used.
 - d. Quantity of chlorides and sulphides used in the product.
- iii. The contractor shall be fully responsible for and shall guarantee proper performance of the entire waterproofing system for a period of 10 (Ten) years from the final completion of works. In addition, specific 10 years written guarantee (to be furnished in a non-judicial stamp paper of value not less than Rs.100/-) in approved proforma shall be submitted for the performance of the system, before final payment and shall not in any way limit any other rights the Employer may have under the contract. Guarantee for water proofing shall comprises of all the items described above in particular specification.
- iv. All water-proofing work shall be carried out through approved specialist agency as per method of working approved by the Engineer-in-charge. However the Contractors shall be solely responsible for waterproofing treatment until the expiry of the above guarantee period.
- v. Ten years guarantee in prescribed proforma attached shall be given by the contractor for the water proofing treatment. In addition 10% (ten percent) of the cost of these items of water proofing under this sub head shall be retained as guarantee to watch the performance of the work executed. However, half of this amount (withheld) would be released after five years from the date of completion of the work, if the performance of the

waterproofing works is satisfactory. The remaining withheld amount shall be released after completion of ten years from the date of completion of work, if the performance of the waterproofing work is satisfactory. If any defect is noticed during the guarantee period, it should be rectified by the contractor within seven days of issuing of notice by the Engineer-in-Charge and, if not attended to, the same shall be got done through other agency at the risk and cost of the contractor and recovery shall be effected from the amount retained towards guarantee. In any case, the contractor and the specialist agency, during the guarantee period, shall inspect and examine the treatment once in every year and make good any defect observed and confirm the same in writing. The security deposit can be released in full, if bank guarantee of equivalent amount, valid for the duration of guarantee period, is produced and deposited with the Department.

25. PARTICULARS SPECIFICATIONS FOR SPACE FRAME

25.1. GENERAL

- i. The work shall be executed and measured as per metric dimensions given in the Schedule of quantities, drawings etc. (F.P.S. units wherever indicated are for guidance only).
- ii. All basic elements / modules / units of stainless steel shall be machine made in factory and only assembly/ erection/ installation shall be done at site.
- iii. The contractor shall submit the details of factory for approval to Engineer-in-charge. Engineer-in-charge shall inspect the factory and approve the same for fabrication of steel furniture. The contractors shall make all necessary arrangements for inspection of the team of Engineer-in-charge
- iv. The manufacturing factory shall be fully equipped with CNC machine for cutting, slotting/ drilling, bending, shaping, welding, grinding, polishing, etc. for achieving desired quality of workmanship.
- v. The minimum production capacity of the stainless steel workshop should be not less than 15MT per month.
 - a. All hardware components like clamps/ nut / bolts/ washers, screws, gaskets, fitting and fixture, brackets, roller/ guide/ slide, caters, hardware etc. as may be required or are forming integral part of the system/ basic elements / modules/ units for construction/ installation shall meet relevant structural and other requirements and be provided without any extra cost to the department.
 - b. All hardware items shall be first quality from reputed manufacturers and shall be got approved from Engineer-in-charge before actual execution.
 - c. All the materials brought to site shall be protected suitably, duly wrapped / packed and stored so as to avoid any damage during loading/ transportation/ unloading/ handling / installation/ erection or due to weather conditions etc. at any stage.
 - d. The contractor shall produce all the materials well in advance so that there is sufficient time for testing of the materials and clearance of the same before incorporation in the work.

25.2. MATERIALS & EXECUTION FOR STAINLESS STEEL FRAME WORK:

- i. The work shall be carried out using AISI SS316 grade stainless steel for all sections (tubes, plates, cleats), nuts, bolts, fasteners, etc.
- ii. The structural design and analysis shall be carried out as per IS 800:2007 and any other relevant IS code.
- iii. The shop drawings along with structural design shall be submitted within 7 days from the date of start of work.
- iv. The manufacturing of framework shall be carried out in workshop approved by Engineer-in-Charge.
- v. All material before being assembled shall be straightened, if necessary, unless required to be curvilinear form and shall be free from twist and shall be assembled in such manner that they are neither twisted nor damaged.
- vi. The pipes shall be welded to the end connector using MMAW/MIG/MAG process. Welding Process shall be in accordance to ISO 4063.
- vii. Weld joints to be cleaned and polished. General Welded tolerances shall be in accordance to ISO 13920-B
- viii. General Tolerances shall be in accordance to ISO 2768-C.
- ix. Joint Preparation shall be in accordance to ISO 9692.
- x. Suitable Fasteners in SS 304 are to be used for mounting of frame / Base Plate on existing floor.
- xi. The agency shall adopt all safety precautions while carrying out erection at site and any damages caused to existing works shall have to be repaired by agency at their own cost and nothing extra shall be paid on such account.
- xii. Contractor and labour will have to follow the discipline and rules of working inside IISER Palitana Campus.

- vi. Measurement shall be as per PIU/ Relevant Specification/Relevant Codes/ Relevant Circular/CPWDs.

26. TECHNICAL SPECIFICATIONS FOR PLUMBING & SANITARY WORKS (INTERNAL BUILDING)

26.1. PLUMBING FIXTURES

- i. All sanitary fixtures, CP Fittings and CP/SS accessories shall be as per manufacturers 'standards / PIU/ Relevant Specification/Relevant Codes/ Relevant Circular/CPWDs.
- ii. All fixtures and fittings shall be provided with all such accessories and fixing devices as are required to complete the item in working condition, even if the same is not specifically mentioned in Specifications or shown on the GFC drawings and will include all devices for proper fixing arrangement, nuts, bolts, screws and required connection pieces etc.
- iii. Wall caps shall be provided on all walls, floors, columns etc. wherever supply and disposal pipes pass through them. These wall caps shall be chromium plated brass fittings and shall be large enough to cover the puncture properly and shall conform to IS: 4291.
- iv. Fixing screws shall be half round head stainless steel wood screws or bolts with Stainless Steel washers. Iron screws will not be permitted.
- v. All fittings and fixtures shall be fixed in a neat workmanlike manner true to level and heights shown on the drawings and in accordance with the manufacturer's recommendations. Care shall be taken to fix all inlet and outlet pipes at correct positions. Faulty locations shall be made good and any damage to the finished floor, tiling or terrace shall be made good at Contractor's cost.
- vi. Contractor shall provide poly-sulphide sealant appropriate for its use for

all fixtures fixed near wall, marble core seal and edges.

26.2. **WATERCLOSETS**

- i. European W.C. shall be any one of the following types:
 - a. Wall hung wash down
 - b. single or double siphon type
- ii. Each W.C. set shall be provided with an approved type of matching plastic seat of approved finish and fitting appropriately with the WC set with rubber buffers and hinges complete. The WC seat shall be those approved and accepted by Engineer-in-charge for fixing on a particular type of WC as per PIU/ Relevant Specification/Relevant Codes/ Relevant Circular/CPWDs.

26.3. **HEALTH FAUCET/SPRAY**

A chromium plated spray with integral hand control valve and connected to a flexible pipe and angle valve with wall flange and hook are to be fixed as directed by the Engineer-in- charge.

26.4. **WASH BASINS**

- i. Wash basins shall wall mounted type or for under over/counter installation as per direction of Engineer-in-charge.
- ii. Each basin shall be supported on GI brackets and the basin securely fixed to wall or under/above counter installation. The design of the brackets shall suit the basin selected and as recommended by the manufacturer.
- iii. Each basin shall be provided with 32 mm dia. C.P. waste with overflow/ pop-up or standard waste with rubber plug and chain, 32 mm dia. C.P. brass bottle trap with CP pipe to wall and flange.
- iv. Each basin shall be provided with a single tap, hot and cold water, Brass CP mixer with or without pop up waste fittings, 32 mm dia. CP cast brass bottle trap with outlet pipe and wall flange.
- v. The edge between the fixture and the wall or the counter shall be sealed with approved type of poly-sulphide sealant
- vi. Washbasins shall be fixed at proper heights as per NBC or as directed by Engineer-in- charge.
- vii. Each washbasin connection (separately for hot and cold) shall be provided with angle valves with CP wall flange and CP connecting pipe and of required length.

26.5. **SINKS**

Sinks for kitchens, pantries, and designated utility rooms the sinks shall be stainless steel sinks with or without drain boards, as required as per PIU/ Relevant Specification/Relevant Codes/ Relevant Circular/CPWDs.

26.6. **SHOWER SET**

- i. Shower set shall comprise of hot & cold water mixer, C.P. shower arm with wall flange and shower head adjustable type.
- ii. Mixer shall be exposed type, single lever, concealed stop cocks with diverter and spout as selected by the Engineer-in-charge and as per PIU/ Relevant Specification/Relevant Codes/ Relevant Circular/CPWDs.

26.7. **ACCESSORIES**

- i. Types of typical accessories:
 - a. Towel rails
 - b. Towel rings

- c. Coat hooks
 - d. Soap dispensers
 - e. Soap dishes
- ii. Accessoriest shall be fixed with stainless steel half round head screws and cup washers in wall with rawl plugs or nylon sleeves and shall include cutting and making good as per PIU/ Relevant Specification/Relevant Codes/ Relevant Circular/CPWDs.

27. SOILS, WASTE, VENT & RAINWATER PIPES & FITTINGS

27.1. SCOPE OF WORK

- i. Work shall consist of furnishing all labour, materials, equipment's and appliances necessary and required to completely install all soil, waste, vent and rainwater pipes and fittings as per PIU/ Relevant Specification/Relevant Codes/ Relevant Circular/CPWDs.
- ii. Without restricting to the generality of the foregoing, the system shall include the following:-
 - a. Floor and urinal traps, cleanout plugs, inlet fittings and rainwater heads / Khurras etc.
 - b. Testing of all pipe lines complete as per PIU/ Relevant Specification/Relevant Codes/ Relevant Circular/CPWDs.

27.2. PIPING SYSTEM

- i. Soil, Waste & Vent Pipes
 - a. The Soil & Waste pipe system above ground has been planned as a "two pipe system" as defined in BIS: having separate pipes for waste for kitchen sinks, showers, washbasins, AHU's condensate drains and floor drains and approved by Engineer-in-charge.
 - b. All waste water from AHU's plant and pump rooms, floor channels in basements will be provided with a deep seal trap before connecting to the main drain or vertical stack.
 - c. Vertical soil & waste stacks shall be connected to a common horizontal drain pipe at basement ceiling or to an external manhole directly where feasible and shown on the drawings.

27.3. RAINWATER PIPES

- i. All terraces shall be drained by providing down-takes rainwater pipes.
- ii. Rainwater pipes are separate and independent and are to be connected to the storm water drainage system.
- iii. Rainwater in enclosed courtyards shall be collected in catch-basins and connected to storm water drains.
- iv. Any dry weather flow from waste appliances, AHU's pump rooms, shall not be connected to the sewerage system.
- v. All work shall be completed as per PIU/ Relevant Specification/Relevant Codes/ Relevant Circular/CPWDs.

27.4. BALCONY/PLANTER DRAINAGE

- i. All balconies, terraces, planters and other formal landscape areas will be drained by vertical down take pipes.
- ii. SWR pipes (disposal of sewerage effluent from buildings to STP) as per IS-13592-92 for pipes and IS-14735-99 for fittings) shall be used.
- iii. All pipes shall be straight and smooth and inside free from irregular bore, blow holes, cracks and other manufacturing defects.
- iv. uPVC pipes & fittings (For Rain Water Pipes etc.)
- v. Where specified, Polythene pipes shall be uPVC pipes confirming to I.S: 4985-2000 as per PIU/ Relevant Specification/Relevant Codes/ Relevant

Circular/CPWDs.

- vi. The details of the nominal outer diameter, weight and working pressure shall be as per the standards, for the respective pressure rating.
- vii. Polythene pipes may be cold bending to a radius of not less than eight times of their external diameter. Pipes bent for smaller radius may be made by hot bending.
- viii. Fittings used for Polythene pipes shall be compression moulded fittings matching to the above specifications.

27.5. JOINTING

- i. All Polythene pipes shall be Drip seal/Sealant and jointed as per manufacturer's specifications and relevant I.S codes.
- ii. All pipes shall be tested after installation for a pressure equal to twice the maximum working pressure in the line as per manufacturer's specifications.

27.6. FITTINGS

- i. Fittings shall conform to the same Indian Standard as for pipes. Pipes and fittings must be of matching IS Specification. Interchange of pipes of one standard with fittings on the other standard will not be permitted.
- ii. Fittings shall be of the required degree of curvature with or without access door.

27.7. SOIL, WASTE PIPE SYSTEM

- i. Above ground piping shall be designed on the basis of two pipe system as recommended in code of practice for soil and waste Hubless centrifugally cast (Span) iron pipes epoxy coated in sides and side as per IS code 15905. Soil pipes shall carry the wastes from WC's & urinals etc. Soil pipes shall connect directly to the 1st manhole outside the building.
- ii. Internal buildings sanitary disposal system will be under the RCC slab (By core cutting RCC slab and suspended at bottom) for hospital zone and with sunken floor in residential buildings.
- iii. Waste pipes shall also carry the wastes from waste appliances (lavatory basins, kitchen sinks etc.). Waste pipes shall connect to Gully Traps outside the buildings and shall be connected to the external manholes.

27.8. DESIGN PARAMETERS

- i. Piping system has been designed in accordance with Code of Practice for Installation of Soil & Waste Pipes up to the 1st manhole with Hubless centrifugally cast (Span) iron pipes epoxy coated in sides and outside as per IS code 15905 and PIU/ Relevant Specification/Relevant Codes/ Relevant Circular/CPWD.
- ii. All vertical stacks will terminate as vent pipes at terrace level.
- iii. All Vertical Stacks in the buildings will terminate at the ground floor level and connected to the external sewer. Pipe dia. and slope will be as per connected load.

27.9. PIPE WORK

- i. All vertical stacks will be installed in pipe shafts on the external face of the buildings or in internal shafts within the building according to the architectural planning of the toilets.
- ii. Provision has been made to provide cleanout doors and plugs for Roding and maintenance where necessary and required.

27.10. MATERIALS FOR SOIL, WASTE & VENT PIPE SYSTEM

- i. Pipes used for Soil, Waste and Vent system shall be Hubless centrifugal cast (Span) iron pipes epoxy coated in-sides and out-side as per IS: 15905 . The pipes and fitting are jointed with SS 304 grade coupling with EPDM rubber gasket joints as per requirement and specifications.

28. WATER SUPPLY SYSTEM

28.1. SCOPE OF WORK

- i. Without restricting to the generality, the water supply system shall include the following:-
 - a. Rising main from water supply pumps to all overhead tanks with HDPE pipes PE-63.8 kg/cm² to IS 4984-1995.
 - b. Distribution system from overhead tank to all fixtures and appliances for cold & hot water with CPVC/HDPE pipes.
 - c. Connections to all plumbing fixtures, and appliances.

28.2. GENERAL REQUIREMENTS

- i. All materials shall be new of the best quality conforming to specifications. All works executed shall be to the satisfaction of the Engineer-in-charge.
- ii. Pipes and fittings shall be fixed truly vertical, horizontal or in slopes as required in a neat workmanlike manner.
- iii. Short or long bends shall be used on all main pipe lines as far as possible. Use of elbows shall be restricted for short connections.
- iv. Pipes shall be securely fixed to walls by suitable clamps at standard intervals as per PIU/ Relevant Specification/Relevant Codes/ Relevant Circular/CPWDs.
- v. Valves and other appurtenances shall be so located as to provide easy accessibility for operations, maintenance and repairs.
- vi. Contractor should study the site plan and water supply system diagram for overviews of the system.

28.3.SOURCE

- i. Water supply will be acquired from state water supply distribution department.
- ii. The rising mains will be connected to the overhead/ fire static tank and then overflow into the main domestic water tanks.
- iii. Water supply piping for garden hydrant and sprinkler and irrigation system will be separate and independent connected to a different pumping system.

28.4. PIPES&FITTINGS

28.5. CONCEALED WATER SUPPLY PIPES

- i. In the water supply system CPVC Pipes shall be provided as per approved designs and as per PIU/ Relevant Specification/Relevant Codes/ Relevant Circular/CPWDs.
- ii. CPVC pipes shall be used in the internal concealed water supply. The CPVC pipes shall be conforming to I.S. 15778-2007and/or ASTM F-441 Schedule 40 of Class specified and having thermal stability for hot & cold water supply and shall be heavy class. The pipe and fitting approved make solvent shall be used as per approved manufacture specification and PIU/ Relevant Specification/Relevant Codes/ Relevant Circular/CPWDs.

28.6. CHLORINATED POLYVINYL CHLORIDE (CPVC) PIPES AND FITTINGS (EXTERNAL WATER SUPPLY PIPES)

- i. CPVC pipes/fittings of specified dia. nominal bore shall conform to I.S. 15778 –

2007 and ASTM F-441 Schedule 40. The pipe fittings, clamps, etc. required for specified dia. bore pipes shall be of best quality and make as approved by the Engineer-in-charge. These pipes shall be as per ASTM F-441, Schedule 40 and having thermal stability for hot & cold water supply, including all CPVC plain & brass threaded fittings, including fixing the pipe with clamps at 1.00 m spacing. This includes jointing of pipes & fittings with one step CPVC solvent cement and testing of joints complete as per direction of Engineer in Charge and complete work as per PIU/ Relevant Specification/Relevant Codes/ Relevant Circular/CPWDs.

28.7. STORAGE TANKS

i. OVERHEAD TANKS

Overhead water storage tanks for water supply shall be reinforced cement concrete/PVC, as per design approved by the Engineer-In-Charge and as per PIU/ Relevant Specification/Relevant Codes/ Relevant Circular/CPWDs. RCC Overhead tanks shall be finished internally with ceramic glazed tiles.

ii. TANK CONNECTION AND ACCESSORIES

Contractor shall provide the following to each tank:

- a. Inlet and outlet connections to pumps, equipment and main pipe lines
- b. Tank overflows with mosquito proof gratings
- c. Scour drain and valve as per drawings
- d. Water level gauge with approved type of brass gauges, plastic tube, a wooden board with level marking.
- e. Electronic level controllers, cabling, sequence controllers and all related equipment shall be provided by agency executing the pumping system work. Plumbing contractor shall provide necessary G.I. sleeves and co-operate with the contractor to ensure that the work is successfully executed.

28.8. EXTERNAL WATER SUPPLY

i. SCOPE OF WORK

The scope of work shall consist of furnishing all labour, materials, equipment and appliances necessary and required for the satisfactory supply, installation, completion and commissioning of water supply pumping system and allied works as described hereinafter, as specified in the schedule of quantities.

ii. THE SYSTEM

The system described below is for the external water supply distribution system is to be planned as per schedule of quantities and shall be executed. This does not form a part of the contractor's scope of work with respect to the various elements that are described in this paragraph.

iii. SOURCES OF SUPPLY

The external water supply shall be met from State government water supply department.

28.9. UNDERGROUND WATER TANKS

- i. RCC Static fire water storage tanks in compartments. Connections from the water supply lines from state government water supply department will be made into these tanks.
- ii. A set of pumps will be connected to and water filter and chlorination system as per requirement and the filtered water stored in the Treated Water Tanks.

28.10. DOMESTIC WATER PUMPING SYSTEMS

- i. Water supply to the various buildings will be made from a set of pumping sets to the overhead water and supplementary fire tanks located on the terrace of each building.

28.11. RISING MAINS & LEVEL CONTROL SYSTEM

- i. Water from the pumps described above will fill each tank by a rising main to each tower.
- ii. To control the level in each tank and enable it to fill as the water demand so requires, each tank will be provided with a ball cock to shut off the water supply when the tank is full.
- iii. A set of electronic level sensing probes will be installed in each tank. The probes installed in each pumping system will be wired to a central electronic panel which will activate the pump when any one of the tank probe signals low water conditions and top up all tanks. No excess flow will occur due to the ball cock in the tank.
- iv. **Level Controllers**
 - a. Level controllers shall be electronic magnetic type using required number of stainless steel type probes, shrouded in PVC sheath or encapsulated in a stainless steel pipe. The level controller will be used for following applications:-
 - b. Provide a audible high water alarm when water level in the sump reaches a pre-determined high level in the sump location at MCC panel installed in wall near sump location

28.12. OVERHEAD TANK LEVEL CONTROLLER CUM INDICATORS

- i. Each OHT to be provided with required number of stainless steel electronically operated probes (housed in a stainless steel protective housing) and connected by a control cable to a central junction box connected to MCC panel located in the pump house at basement. A common multi-core cable from each group of buildings will be laid to the pump room in basement. The probes will function as follows:
- ii. To cut off the water supply pumps when all the OHT is full and to start the pump if any OHT level reaches at pre-determined low level.
- iii. Provision shall be made to enable the operation of the second duty pump in case the water level does not rise above a pre-determined level in the tank due to water demand which is higher than capacity of duty pump no.1 to meet.
- iv. Indicate the water level in each OHT in the level indicating panel installed in the pump room
- v. Each OHT are also provided with a float valve to stop the supply in individual
- vi. OHT when level reaches a cut off high level.

28.13. CONTROL & INDICATING PANEL (FOR OVERHEAD AND UNDERGROUND WATER TANKS)

- i. A centralized indicating stand-alone wall mounted panel fabricated from 14 g. with seven tank process MS sheet and painted inside and outside with stove enamelled finish with clear vertical panels for each group of buildings & tanks shall indicate water level in each tank by means of digital display unit to indicate water level in each tank in four levels ($\frac{1}{4}$ th, $\frac{1}{2}$, $\frac{3}{4}$ and full). The panel shall be installed on the control console panel located in the pump room or as directed by the Engineer-In-Charge. The panel shall have:
 - a) Digital level indicator panel meter for each water tank.
 - b) Etched plate identification plates.
 - c) Control cabling from MCC to the panel installed in the control room as directed

- by the Engineer-In-Charge.
- d) Cabling from PHT sensing probes to the panel

29. TECHNICAL SPECIFICATIONS FOR WTP/STP/ETP/SOLAR HOT WATER SYSTEM/HEAT PUMP

29.1. SCOPE OF WORK

- i. Design, Engineering Supply, Installation, Testing & Commissioning of WTP shall be carried out by the Contractor on percentage rate Bid on the basis & as directed by Engineer-in-charge.
- ii. Work shall consist of furnishing all labour, materials, equipment and appliances necessary and required. The Contractor is required to completely furnish all the plumbing and other specialised services as described hereinafter and as specified in the schedule of items
- iii. Without restricting to the generality of the foregoing, this section shall include the following:-
 - a) Water supply/lifting Pumps
 - b) Filters (dual media/activated carbon/pressurized sand), Softeners etc.
 - c) Pumps & Allied Equipment
 - d) STP & ETP
 - e) Solar Hot Water System
 - f) RO System
 - g) Pumps

29.2. SPECIFICATIONS

- i. Work under this Contract shall be carried out strictly in accordance with specifications attached with the Bid document
- ii. Items not covered under these specifications or due to any ambiguity or misprints, or additional works, the work shall be carried out as per specifications of the latest Central Public Works Department with up to date amendments as applicable in the Contract.
- iii. Works not covered under Paras above shall be carried out as per relevant Codes & Bureau of Indian Standards and in case of its absence as per British Standard Code of Practice.

29.3. EXECUTION OF WORK

- i. The Contractor should visit and examine the site of work and satisfy himself as to the nature of the existing roads and other means of communication and other details pertaining to the work and local conditions and facilities for obtaining his own information on all matters affecting the execution of work.
- ii. The work shall be carried out in conformity with the Plumbing items and within the requirements of specifications and coordinated with all services detailed drawings.
- iii. The Contractor shall cooperate with all trades and agencies working on the site. He shall make provision for hangers, sleeves, structural openings and other requirements well in advance to prevent hold up of progress of the construction schedule. All supports to the civil structure shall be provided with dash fasteners.
- iv. On award of the work, Contractor shall submit a schedule of construction in the form of a PERT chart or BAR chart for approval of the Engineer-In-Charge/ CPWD. All dates and time schedule agreed upon shall be strictly adhered to within the stipulated time of completion/ commissioning along with the specified phasing, if any.

29.4. DRAWINGS

- i. All the necessary drawings/Schematic of WTP/RO/ETP/STP/Solar Hot water system/ Heat Pumps are provided to the Contractor. On the basis of these, shop drawings will be prepared & submitted to Engineer-in-charge/CPWD for approval. The execution of work shall be done in-line with the approved shop drawings.
- ii. Working drawings shall take precedence over plumbing or other services drawings as to all dimensions.
- iii. Contractor shall verify all dimensions at site and bring to the notice of the Engineer-In-Charge all discrepancies or deviations noticed. Decision of the Engineer-In-Charge shall be final.
- iv. Large size details and manufacturers dimensions for materials to be incorporated shall take precedence over small scale drawings.
- v. Any drawings issued by the Engineer-in-charge/CPWD for the work are the property of the Engineer-in-charge/ CPWD and shall not be lent, reproduced or used on any works other than intended without the written permission of the Engineer-in-charge/ CPWD.

29.5. REFERENCEDRAWINGS

- i. The Contractor shall maintain one set of all drawings issued to him as reference drawings. These shall not be used on site. All important drawings shall be mounted on boards and placed in racks indexed. No drawings shall be rolled.
- ii. All corrections, deviations and changes made on the site shall be shown on these reference drawings for final incorporation in the completion drawings to be submitted by the contractor in fulfilment of the conditions of this contract.
- iii. On award of the work the contractor shall be issued, one set of working drawings stamped by the Engineer-In- Charge. The CPWD drawings shall be the basis of contractor's shop drawings. Upon submission of shop drawings to CPWD, Final approved drawings will be stamped as "Good for Construction" drawings, based on which execution work will be done.
- iv. Shop drawings are detailed working drawings which incorporate the contractor's details for execution of the work and incorporate equipment manufacturer's details and dimensions to ensure that the same can be installed in the space provided.
- v. All shop drawings should detailed pipe routing and levels, showing location of other services at crossings etc., cable runs, route cable trays and all allied works and must be fully co-ordinated with other services and approved by the Engineer-In-Charge before execution of the works. Engineer-In-Charge shall arrange to issue one copy/print of services drawings (if required for coordination of services).
- vi. Shop drawings shall be furnished for detailed layout of all equipment, foundation, bolting and vibration elimination details along with information on dead and dynamic load, vibration etc.
- vii. Two sets of manufacturer's equipment drawings, roughing in and wiring diagrams shall be submitted.
- viii. Contractor shall submit shop drawings furnishing all details of MCC panels, cable routes, wiring diagrams and connection details as required.
- ix. Two copies of each set of shop drawings shall be submitted for initial scrutiny, discussion and approval.
- x. Each submission shall be accompanied by contractor's certificate stating that the shop drawings meet all the contract requirements and that the

piping and equipment can be satisfactorily installed without any obstructions in the space available.

- xi. On approval of the above the contractor shall furnish three sets of the approved shop drawings for execution of the work.

29.6. INSPECTION AND TESTING OF MATERIALS

- i. Contractor shall be required, if requested, to produce manufacturers test certificate for the particular batch of materials supplied to him. The tests carried out shall be as per the relevant Bureau of Indian Standards.
- ii. For examination and testing of materials and works at the site Contractor shall provide all testing and gauging equipment necessary but not limited to the following:
 - a) Steel tapes
 - b) Weighing machine
 - c) Plumb bobs, spirit levels, hammer
 - d) Micrometers
 - e) Hydraulic machine
- iii. All such equipment shall be tested for calibration at any approved laboratory, if required by the Engineer-In-Charge. All testing equipment shall be preferably located in special room meant for the purpose.
- iv. Samples of all materials shall be got approved before placing order and the approved samples shall be deposited with the Engineer-In-Charge.

29.7. METRIC CONVERSION

- i. All dimensions and sizes of materials and equipment given in the drawings are commercial metric sizes.
- ii. Any weights, or sizes given in the drawings having changed due to metric conversion, the nearest equivalent sizes accepted by Indian Standards shall be acceptable without any additional cost.

29.8. COMPLETION DRAWINGS

- i. On completion of work, Contractor shall submit one complete set of original tracings and four print of "as built" drawings to the Engineer-in-Charge CPWD. These drawings shall have the following information.
 - a) Run of all piping, diameters on all floors, vertical stacks and location of external services.
 - b) Ground and invert levels of all drainage pipes together with location of all manholes and connections up to outfall.
 - c) Run of all water supply lines with diameters, locations of control valves, access panels.
 - d) Location of all mechanical equipment with layout and piping connections and mechanical equipment.
 - e) All shop drawings shall be updated from time to time for the purpose of making completion drawings.
- ii. No completion certificates shall be issued unless the above drawings are submitted.
- vii. Contractor shall provide four set of catalogues, service/operation & maintenance manuals, manufacturer's drawings, performance data and list of spare parts together with the name and address of the manufacturer for all electrical and mechanical equipment provided by him.
- viii. All "warranty cards" given by the manufacturers shall be handed over to the Engineer-In-Charge/CPWD.

29.9. TESTING

- i. Piping and drainage works shall be tested as specified under the relevant clauses of the specifications.
- ii. Tests shall be performed in presence of the Engineer-In-Charge and test records for the tests shall be duly signed by Contractor and the Engineer-In-Charge.
- iii. All materials and equipment found defective shall be replaced and whole work tested to meet the requirements of the specifications.
- iv. Contractor shall perform all such tests as may be necessary and required by the local authorities to meet municipal or other bye-laws in force.
- v. Contractor shall provide all labour, equipment and materials for the performance of the tests.

29.10. SITECLEARANCE ANDCLEANUP

- i. The Contractor shall, from time to time, clear away all debris and excess materials accumulated at the site.
- ii. After the fixtures, equipment and appliances have been installed and commissioned, Contractor shall clean-up the same and remove all plaster, paints, stains, stickers and other foreign matter or discolouration leaving the same in a ready to use condition.
- iii. On completion of all works, Contractor shall demolish all stores, remove all surplus materials and leave the site in a broom clean condition, failing which the same shall be done by the Engineer-In-Charge at the Contractor's risk and cost. Cost of the cleanup shall be deducted from the contractor's bills on pro-rata basis in proportion to his contract value.

29.11. LICENSE PERMITS ANDAUTHORITIES

- i. Contractor must hold a valid plumbing or any other as required licence by the municipal authority or other competent authority under whose jurisdiction the work falls.
- ii. Contractor must keep constant liaison with the local development, municipal /statutory authority and obtain approval of all drainage, water supply, fire suppression and other works carried out by him.
- iii. Contractor shall obtain, from the municipal and other authorities 'C' & 'D' & other forms as required for approval of drainage and water supply works during execution and the completion certificate with respect to his work as required for occupation of the building. Contractor shall obtain permanent water supply and drainage connections from authorities concerned. Engineer-in-charge / CPWD shall reimburse the fees paid to the authorities towards the connection charges on production of receipts for money paid.
- iv. Contractor shall get any materials tested from the appropriate authority if so required with no cost to the Engineer-in-charge / CPWD.

29.12. CUTTING OF WATERPROOFINGMEMBRANE:

- i. No walls terraces shall be cut for making and opening after water proofing has been done without written approval of Engineer-In-Charge. Cutting of water proofing membrane shall be done very carefully so as other portion of water proofing is not damaged. On completion of work at such place the water proofing membrane shall be made good and ensured that the opening/cutting is made fully water proof as per specifications and details of water proofing approved by Engineer-In-Charges.

29.13. MATERIALS

- i. Unless otherwise specified and expressly approved in writing by the Engineer-In-Charge, only materials of makes and specification as mentioned in the list of approved makes attached with the specifications shall be used.
- ii. If required, the Contractor shall submit samples of materials proposed to be used in the works. Approved samples shall be kept in the office of the Engineer-In-Charge.

30. WATER SUPPLY, FLUSHING/IRRIGATION PUMPS& EQUIPMENT

30.1. GENERALREQUIREMENTS

- i. All materials shall be new of the best quality conforming to specifications and subject to the approval of Engineer-In-Charge.
- ii. All equipment shall be of the best available make manufactured by reputed firms.
- iii. All equipment shall be installed on suitable foundations true to level and in a neat workmanlike manner.
- iv. Equipment shall be so installed as to provide sufficient clearance between the end walls and between equipment to equipment.
- v. Piping within the pump house shall be so done as to prevent any obstruction in the movement within the pump house.
- vi. Each pumping set shall be provided with a butterfly valve on the suction and delivery side and a flap type non return valve on the delivery side
- vii. All pump couplings and belt guards for air compressors shall be totally enclosed with 5 mm mesh.

30.2. SYSTEM OF WATER SUPPLY

- i. The water supplied by the authorities will be stored in the domestic U.G. tank.
- ii. Water from this U.G. tank shall be pumped to O.H. Tanks at terrace of each building by separate pumps/sump.
- iii. Each toilet and kitchen shall be fed with water from terrace tanks by gravity from two / three floors of Buildings will be fed by Hydro-pneumatic System from terrace.

30.3. RISING MAINS& LEVEL CONTROL SYSTEM

- i. Water from the pumps described above will fill each tank by a rising main to each tower.
- ii. To control the level in each tank and enable it to fill as the water demand so requires, each tank will be provided with a ball cock to shut off the water supply when the tank is full.
- iii. A set of electronic level sensing probes will be installed in each tank The probes installed in each pumping system will be wired to a central electronic panel which will activate the pump when any one of the tank probe signals low water conditions and top up all tanks. No excess flow will occur due to the ball cock in the tank.

30.4. LEVEL CONTROLLERS

- i. Level controllers shall be electronic magnetic type using required number of stainless steel type probes, shrouded in PVC sheath or encapsulated in a stainless steel pipe. The level controller will be used for following applications:-

- a. Provide a audible high water alarm when water level in the sump reaches a pre-determined high level in the sump location at MCC panel installed in wall near sump location

30.5. OVERHEAD TANK LEVEL CONTROLLER CUM INDICATORS

- i. Each OHT to be provided with required number of stainless steel electronically operated probes (housed in a stainless steel protective housing) and connected by a control cable to a central junction box connected to MCC panel located in the pump house at basement. A common multi-core cable from each group of buildings will be laid to the pump room in basement. The probes will function as follows:
 - ii. To cut off the water supply pumps when all the OHT is full and to start the pump if any OHT level reaches at pre-determined low level.
 - iii. Provision shall be made to enable the operation of the second duty pump in case the water level does not rise above a pre-determined level in the tank due to water demand which is higher than capacity of duty pump no.1 to meet.
 - iv. Indicate the water level in each OHT in the level indicating panel installed in the pump room
 - v. Each OHT are also provided with a float valve to stop the supply in individual OHT when level reaches a cut off high level.

30.6. CONTROL & INDICATING PANEL (FOR OVERHEAD AND UNDERGROUND WATER TANKS)

- i. A centralized indicating stand-alone wall mounted panel fabricated from 14 g. with seven tank process MS sheet and painted inside and outside with stove enamelled finish with clear vertical panels for each group of buildings & tanks shall indicate water level in each tank by means of digital display unit to indicate water level in each tank in four levels ($\frac{1}{4}$ th, $\frac{1}{2}$, $\frac{3}{4}$ and full). The panel shall be installed on the control console panel located in the pump room or as directed by the Project Engineer. The panel shall have:
 - ii. Digital level indicator panel meter for each water tank.
 - iii. Etched plate identification plates.
 - iv. Control cabling from MCC to the panel installed in the control room as directed by the Project Manager.
 - v. Cabling from PHT sensing probes to the panel

31. TECHNICAL SPECIFICATION FOR (WTP)

31.1. FILTERS-DUAL MEDIA/ACTIVATED CARBON / PRESSURIZED SAND TYPE & SOFTENER

i) PRESSURE FILTERS FOR WATER SUPPLY SYSTEM

- a) Pressure filters shall be manufactured with factory made bobbin wound polyester fibre glass multilayer filters fitted with internal GI distribution pipe with polypropylene diffusers on top, collector pipes and arms, inlet and outlet header vertical water pressure dished ends complete with initial charge of filter media, G.I. face piping, accessories testing and commissioning complete, Working Pressure 2.4 kg/cm² (Test pressure 3.75 kg/cm²). Along with BFV & NRV & gauge, etc.
- b) Each vessel will be provided with suitable pressure tight manhole cover appropriately located for inspection and repairs.

- c) The diameter and height of each vessel shall be as per the design requirement and as per site conditions.

31.2. MULTI-PORT VALVES

- a) Each vessel will be provided with multi-port valves to operate and regulate the normal flow, backwash and rinsing, rapid washing, on the face piping.
- b) Provide suitable sampling cocks to draw water samples for raw water and treated water.

31.3. FACE PIPING

- a) Each vessel shall be provided with non-corrosive face piping from the inlet to the outlet. Face piping shall be CPVC (IS 4985)/UPVC/GI 10 kg/cm² all CPVC/UPVC/GI fittings are heavy grade to pipe and solvent weld and flanged joints
- b) All valves shall be butterfly valves as specified in the piping section over 65 mm dia. and for pipe dia. below 50 mm dia. shall be provided with ball valves.

31.4. WATER FILTRATION PLANT (FOR DOMESTIC WATER)

- i. Design parameters for the proposed filters shall be as follows:
 - a) Filter media:- Graded aggregate of required size selected coarse and fine silica sand as per latest water treatment practice. Aggregate and sand to be acid washed and having purity of 99.9%.
 - b) Depth of filter media:- Approx. 750-900 mm deep (as per manufacturer's design)
 - c) Back washing :- By air scouring through air blower (approx. 5.1 lpm/m² of filter surface area and water supply from raw water pumps by reverse flow)
 - d) Output Water Quality for Domestic Filters: To conform to IS 10500 for the relevant design criteria.

31.5. CHEMICAL DOSING PUMPS

- i. Dosing system comprising of an electronic metering pump with, 100 lit capacity uPVC/HDPE solution tank with level gauge and lid on top.
- ii. Electronic driven metering pumps with mechanically actuated diaphragm with oil lubricated gear mechanism. The output of the pump should be adjustable for operation from 10-100%. Pump construction shall be corrosion resistant polypropylene or similar material. Pump electrical circuit shall be interlocked with the main raw water /pool recirculation pumps so that they operate only when the pumps are operating.

31.6. AIR BLOWER FOR BACK WASHING

- i. Low pressure air blower with TEFC electrical motor, belt driven or direct drive, all mounted on a common structural based plate with oil and water separator.
- ii. Air blowers will be used for back washing operations. The air blower shall be designed for operation of one filter at a time. Blowers will be designed for air flow of approx 5.1 lpm/m² air capacity at 0.5 kg/cm² pressure. (This may be modified to suit manufacturer's requirement for filters offered.)
- iii. The electrical switchgear shall be included in the respective MCC panel of the system

31.7. SOFTENER

- i. Specifications shall be as per requirements. As per discharge head, HOS shall be decided, dimension of shell shall be accordingly selected, optimum Resin quantity should be selected with required OBR provisions to be considered. Softener shall be of MS with inner shell FRP lined. It should be provided with back wash, regeneration facility.
Max. Working pressure : 3.5 Kg/cm²
Min. Working pressure : 2.0 Kg/cm²
- ii. Output water parameters should be as per GRIHA norms & relevant IS standards.

32. PUMPS:-

32.1. WATER TRANSFER PUMPS

- i. Water supply pumps shall be suitable for clean filtered water. Pumps shall be single
- ii. stage, monobloc vertical / horizontal, centrifugal pumps with cast iron body and bronze/gun metal impeller, stainless steel shaft and mechanical seal and coupled to a TEFC electric motor. Each pump should be operating to a curve required by the operating conditions. MOC stated in DBR for pumps will be deemed as final.
- iii. All parts in contact with water shall be corrosion resistant stainless steel DIN-Nr.1.4401.
- iv. Each pump shall be provided with a totally enclosed fan cooled induction motor of suitable
- v. H.P. The motors shall be suitable for 410 volts, 3 phases, 50 cycles A.C. power supply and shall conform to IS 325 operating at 1450 RPM nominal speed.
- vi. Each pumping set shall be provided with 100-mm dia gunmetal "Bourden" type pressure gauge with gunmetal valve and connecting piping.
- vii. Pump or the whole set shall be stable on rubber vibration eliminating pads appropriate for each pump as recommended by the manufacturer and accepted by the Engineer-In-Charge.

32.2. SUBMERSIBLE PUMPS

- i. Submersible pumps for clear water transfer shall be single stage, submersible centrifugal Pump of closed coupled construction with C.I. casing and Gun Metal/bronze impeller connected to a fully submersible water/ oil cooled motor.
- ii. Stuffing box shall be provided with mechanical seals.
- iii. Each pump shall be provided with water cooled Squirrel Cage Induction Motor suitable for 415 Volts, 3 phase, 50 cycles AC power supply.
- iv. Each pump shall be provided with liquid level controller for automatic operation of the pump between predetermined levels. Operation of level controller shall be similar to as discussed in subsequent paras below.
- v. The pumping set shall be for stationary application and shall be provided with pump connector in it. The delivery pipe shall be joined to the pump through a rubber diaphragm, and bend and guide pipe for easy installation, without disturbing delivery pipe the pump unit shall have a back pull out design. A rust proof chain shall be provided for each pump.
- vi. Pump shall be provided with all accessories and devices necessary and required for the pump to make a complete working system.
- vii. The Pump shall be located at a position directly beneath the manhole to ensure proper accessibility.

33. HYDROPNEUMATIC SYSTEM

33.1. PRESSURISED WATER BOOSTING SYSTEM USING VARIABLE SPEED DRIVE

- i. The booster set shall consist upto a maximum of six identical vertical multistage in - line pumps in cast iron GG20 pump head & base c/w cataphoresis coating, cartridge type mechanical seal, all internals in AISI 304 stainless steel, mounted on common galvanised steel base frame and controlled by variable frequency drives & a PFU (Pump Functional Unit) logic controller, which have features like application optimised software, regular optimization of operating conditions and read-out of operating data, Bus Communication possibility, Digital remote-control functions, pump & system monitoring functions, Display, Alarm & signal functions and clock programs. Panel to have 2x24 character LCD display, green & red LED's for operating & fault indication, potential free contacts for remote interfacing, an inbuilt lifetime battery backup for all clock functions.
- ii. Booster set should include non-return valves, isolating valves, pressure transmitter on discharge side, non-return valve, pressure gauge all mounted on a factory assembled SS manifolds.
- iii. Booster set should ensure constant pressure on discharge side through continuously variable adjustment of speed of one of the pumps, while the remaining pumps in operation are running on mains operating at full speed to bring about pump performance to meet consumption levels. Also provision should be made for alternate change over between pumps in operation once every 24 hours & frequency converter operation of pumps by rotation - all should be built in, cyclically, in the controls to ensure equal wear and tear of all pumps in the booster set. Means should be provided for friction loss compensation for increased consumption rate.
 - a) Booster set should incorporate following "Power saving features" as standard.
 - Selection of 3 basis setpoints for pressure relative to time.
 - Pipe compensation i.e. Change of setpoint depending on water consumption.
 - Compulsory change of starting sequence, i.e. Equal operating time for pump, both for frequency control and ON/OFF regulation.
 - Inputs and outputs for external communication.
 - b) A small sized pressure tank, (accumulator) to provide for reducing impact of water hammer and minimize short cycling of the pumps. The accumulators are piped to allow for in service maintenance.
 - c) The functions of the Controller should incorporate the following features.,
 - Closed loop control.
 - On / Off operation at low flow.
 - Automatic cascade control of pumps
 - Selection of switching sequences , automatic pump change and pump priority.
 - Manual Operation.
 - Analog set point influence
 - Friction loss compensation
 - Set point adjustment
 - d) The remote control functions should have the following features.,
 - System On / Off
 - Set point control
 - Switching of individual pumps
 - The monitoring functions should have the following features.,
 - Min / Max Levels
 - Pre pressure

- Motor protection
- Water shortage monitoring
- Enclosure Class: Control Box IP 54. Motors IP 55.

33.2. PIPE & FITTINGS (FOR HEADERS AND CONNECTIONS)

- Pump suction and delivery headers shall be Galvanized iron pipes/MS heavy class with matching fittings. The pipe joints shall be threaded as per manufacturer's instructions.

33.3. VIBRATION ELIMINATORS

All suction and delivery lines as shown on the drawings shall be provided with double flanged reinforced neoprene flexible pipe connectors. Connectors should be suitable for a working pressure of each pump and tested to the test pressure given in the relevant head. Length of the connectors shall be as per site requirements in accordance with manufacturer details.

33.4. VALVES

i. Sluice valves

- Full way Sluice Valves shall be used on the suction connection to pumps and headers.
- Sluice valves (80 mm dia. and above) shall be C.I. double flanged sluice valves with rising stem. Each sluice valve shall be provided with wheel in exposed positions and cap top for underground valves. Contractor shall provide suitable operating keys for sluice valves with cap tops.
- Sluice valves shall be of approved makes conforming to I.S. 780 PN 1.6 class

ii. Butterfly Valves (PN 1.6 rating)

- Butterfly Valves shall be used in all other locations as required conforming to IS 13095. PN 1.6
- They shall have a cast iron body.
- Disc shall be CI heavy duty electrolyses nickel plated abrasion resistant.
- The shaft to be EN-8 Carbon Steel with low friction nylon bearings.
- The seat shall be drop tight constructed by bonding resilient elastomer inside a rigid backing.
- Built in flanged rubber seals.
- Actuator to level operated for valves above ground and T Key operated for valves below Ground.
- Built in flanges for screwed on flanged connections. Manufacturer's details on fixing and Installation will be followed.

iii. NON RETURN VALVES (NRV PN 1.6 RATING)

- Non return valves will be used at location to allow flow only in one direction and prevent flow in the opposite direction.
- NRV shall be cast iron slim type with cast iron body and gunmetal internal parts and accompanying flanges. Valves shall conform relevant IS or match the butterfly valves. PN 1.6
- Built in flanges for screwed on flanged connections.

iv. BALL VALVES

- Ball Valves up to 40 mm dia. shall be screwed type ball valves with stainless steel balls, spindle, Teflon seating and gland packing tested to a hydraulic pressure of 20 kg/cm² and accompanying coupling and steel handles to B.S. 5351.

v. **'Y' STRAINERS (PN 1.6 RATING)**

- a) Provide cast iron 'Y' type strainers with gun metal internal strainers, CI screwed plug to be provided on all water tank suction connections to pumps

33.5. **PAINTING AND CLEANUP**

- a) On completion of the installation contractor shall scrub clean all pumps, piping, filters and equipment and apply one coat of primer.
- b) Apply two or more coats of synthetic enamel paint of approved make and shade on steel pipes.
- c) Provide painted identification legend and direction arrows on all equipment and piping as directed by Engineer-in-Charge.
- d) On final completion of the work, contractor should cleanup the site, filter room of all surplus materials rubbish and leave the place in a broom-clean condition.

33.6. **CABLES**

- a) Contractor shall provide all power and control cables from the motor control centre to various motors, level controllers and other control devices.
- b) XLPE Cables shall be provided conforming to I.S. 7098.
- c) Wiring cables shall conform to IS 694.
- d) All power and wiring cables shall be aluminium conductor PVC insulated armoured and XLPE sheathed of 1100 volts grade.
- e) All control cables shall be copper conductor PVC insulated armoured and XLPE sheathed 1100 volts grade.
- f) All cables shall have stranded conductors. The cables shall be in drums as far as possible and bear manufacturer's name.
- g) All cable joints shall be made in an approved manner as per standard practice.

33.7. **EARTHING**

- a) All equipment installed by the contractor shall be suitably earthed by making proper connection by means of G.I. Wire to the main earthing system laid by the electrical contractors.

33.8. **MOTOR CONTROL CENTRES**

- i. Switchboard cubicles of approved types shall be fabricated from 2mm M.S. Sheet with dust and vermin proof construction. It shall be painted with stove enamel paint of approved make and shape. It shall be fitted with suitable etched plastic identification plates for each motor. The cubicles shall comprise of the following:-(switchgear as given in the schedule of quantities).
 - a) Incoming main switch fuse unit of required capacity.
 - b) Isolation switch fuse unit, one for each motor.
 - c) Fully automatic DOL/star delta starters suitable for motor H.P. with push buttons one for each motor and on/off indicating neon lamps.
 - d) Single phasing preventer of appropriate rating for each motor.
 - e) Rotary duty selector switch.
 - f) Panel type ampere meters one for each motor.
 - g) Panel type voltmeter on incoming main with rotary selector switch to read voltage between phase to neutral and phase to phase.
 - h) Neon phase indicating lamps and indicating lamp for each motor.

- i) Rotary switch for manual or auto operation for each pump.
- j) Fully taped separate aluminium bus bars of required capacity for normal and emergency supply where specified.
- k) The panel shall be prewired with colour coded wiring. All interconnecting wiring from incoming main to switch gear, meters and accessories within the switch board panel. All switch gears and accessories shall be approved make.
- l) All switch gears and accessories shall be approved make.
- m) Switchboard cubicles shall be floor or wall mounted type as recommended by manufacturers.

33.9. MEASUREMENT

i. GENERAL

- a) Unit rate for individual items, e.g, Pumps, MCC and level controller are for purposes of payments only. Piping, headers, valves, accessories, cabling and MCC to measured separately in this contract only.
- b) All items must include all accessories fittings as described in the specifications, DBR.

ii. PIPINGWORK

- a) Suction and delivery headers for each pumping system shall be measured per linear meter of finished length and shall include all items as given in the schedule of quantities. Painting shall be included in rate of headers.
- b) G.I. pipes between various equipment's shall be measured per linear meter of the finished length and shall include all fittings, flanges, jointing, clamps for fixing to walls or hangers and testing. Flanges shall include 3 mm thick insertion rubber gasket, nuts, bolts and testing.
- c) Water Tank, Vibration eliminators, "Y" strainers, butterfly valves, slim non return valves shall be measured by numbers and shall include all items as given in the schedule of quantities and specifications.

33.10. INSTALLATION, COMMISSIONING&GUARANTEES

i. INSTALLATION

- a) Contractor shall supply required number of copies of foundation drawings giving weight, vibration and other loads required for the proper designing of the foundations.
- b) All equipment shall be installed in a true workman like manner true to level and grade in accordance with the best current practice.
- c) Contractor shall employ sufficient and proper equipment for lifting and placing of heavy equipment and in a manner which shall not strain or cause damage to the existing structures. If any damage is done, the same shall be made good to the satisfaction of the Engineer-In-Charge without any additional cost.
- d) All equipment and pipes shall be painted with one coat of red oxide before dispatch to the site.

ii. COMMISSIONING

- a) On completion of the work in all its aspects, the contractor shall start up the equipment in a manner normally done for the continuous operation for a period of not less than 48 hours and shall rectify and adjust the equipment for leakages and balancing the system.
- b) After satisfactory commissioning of the plant, the contractor shall conduct performance tests on the equipment to satisfy the Engineer-In- Charge that all equipment is performing to the rated outputs. Any or all

equipments shall be rectified or replaced if the same is are not performing in accordance with the specifications.

iii. GUARANTEES

- a) On completion of the work contractor shall submit a guarantee covering the quality and performance of all materials supplied and installed under the contract. This guarantee shall cover each and every material whether manufactured by the contractor or not.
- b) Contractor shall specify a suitable procedure to test the rated performance of the equipments and shall provide all necessary equipments, gauges etc. for conducting such tests.
- c) The guarantee shall cover a period of one year from the date of installation and handing over.

iv. COMPLETION

- a) On completion of the job, the contractor shall hand over to the Engineer-In-Charge the following:-
- b) One flow chart drawn in ink on thick paper and mounted in a glass frame showing the flow diagram of the process including legend showing valves to be normally open or closed and instructions for back washing, operation and maintenance of chlorination & other chemical feeding pumps and other equipments.
- c) Five sets of operating and maintenance instructions with spare parts list and their manufactures and/or suppliers.
- d) Five sets of catalogues and drawings for all equipment supplied.

v. TECHNICAL INFORMATION

Please furnish full details separately

All information should be on the following format

PUMPS			
S.No.	Description	Domestic	Irrigation water
1.	Design basis		
	1.1. Quantity/ No.of units offered		
	1.2. Capacity lit/lpm		
	1.3. Flow Range		
	1.4. Pumping Head (where applicable)		
	1.5. Make & Model No.		
	1.6. Power		
	1.7. Pump Type		
	1.8. Material (body)		
	1.9. Material (Impellers)		
	1.10. Material (shafts)		
2.	Accessories		
3.	Valves		
	3.1. Type		
	3.2. Material (body)		
	3.3. Material (Internal parts)		
	3.4. Material (Lining)		
4.	Pipes		
	4.1. Type		
	4.2. Material		
	4.3. Max. working pressure		

PIPE COLOUR CODE

This ColourCode is as per I.S.2379.

Ground Colour

1st ColourBand

2nd Colourband

Proportional width ofband 4:1

Pipe lines

Ground Color

1st Color

2nd Color

1. Drinking water (all cold water lines after filter)

Seagreen

Frenchblue

Signal red

2. Treated water (softwater)

Seagreen

Light orange

3. Domestic hot water

Seagreen

Light grey

5. Drainage Sewer/SWD

Black

6. Fire services

Fire red - This ColorCode is as per I.S.2379

Final design for colourcoding will be of Engineer-In-Charge / CPWD only.

34. TECHNICAL SPECIFICATIONS OF STP:-

34.1. Design, Engineering Supply, Installation, Testing & Commissioning of STP shall be carried out by the Contractor on Percentage rate Bid of basis & as directed by Engineer-in-charge.

Note: GRIHA norms & relevant IS standards (output water for irrigation/ flushing/ sewer/ portable) for output water parameters should be complied with.

The Sewage Treatment Plant shall be designed on MBR technology for the following raw sewage flow rate and characteristics:

34.2. SEWAGE GENERATION AND CHARACTERISTICS

Zone I

Flow Rate	225	KLD (215 KLD – SEWAGE LOAD	10
KLD		EFFLUENT TREATED LOAD)	

BOD5	250-450mg/l
COD	600-800mg/l
TSS	250-400mg/l
pH	6.5- 8.5
Oil & Grease :	50mg/l
Temperature	30- 40 degreeCelcius

Zone II

FlowRate	: 425 KLD (425KLD-SEWAGE LOAD)
BOD5	: 250-450mg/l
COD	: 600-800mg/l
TSS	: 250-400mg/l
pH	: 6.5- 8.5
Oil & Grease	: 50mg/l
Temperature	: 30- 40 degreeCelsius

34.3. TREATED SEWAGE QUALITY

Thetreatedsewagewillconformtothefollowingqualitystandardsoras desiredas per relevant IS code dependingupon type of usage standards:

BOD 5	: <5mg/l
COD	: < 10mg/l
TSS	: <1mg/l
pH	: 6.5- 8.5
Oil & Grease	: Nil

34.4. TECHNICAL EQUIPMENT SPECIFICATIONS

i) PRIMARY TREATMENT

a) SCREENS

Quantity	: 2Nos.oras required
Dimension	: Wide: 600mm X Height: 1200mm
MOC	: StainlessSteel
Type	: Perforated
Screening Size	: 20mm&10mm
Lifting Arrangement	: Yes

ii) PUMPSET

a) RAW SEWAGE TRANSFER PUMPSET(CollectionTank to AerationTank)

Quantity	: 2Nos.(1W +1S) oras required
Type	: Submersible,Vertical
MOCofBody / Impeller	: CI/ Bronze
Capacity	: As Required
Head	: As Required
SolidHandling Capacity	: As Required
MotorRating	: As required fulfilling technical parameters
Lifting Arrangement	: Manual MSEP

b) PLANT ROOM SUMP PUMPSET

Quantity	:	2Nos.(1W +1S) oras required
Type	:	Submersible, Vertical
MO Cof Body / Impeller	:	CI/ Bronze
Capacity	:	As Required
Head	:	As Required
Solid Handling Capacity	:	As Required
Motor Rating	:	As required fulfilling technical parameters
Lifting Arrangement	:	Manual MSEP

c) SLUDGE TRANSFER/RECIRCULATION PUMPSET

Quantity	:	2Nos.(1W +1S) oras required
Type	:	Monoblock. Centrifugal
MO Cof Body / Impeller	:	CI/ Bronze
Capacity	:	As Required
Head	:	As Required
Solid Handling Capacity	:	As Required
Motor Rating	:	As required fulfilling technical parameters

Providing, installation, testing & commissioning of screw Sludge disposal pump for the disposal of sludge to tanker or to sludge dry beds. The pumps shall have CI casing, bronze Impeller & SS shaft & sleeve with mechanical rotary shaft seal connected by a flexible tie rod type coupling to TEFC induction motor mounted on a common channel base-plate with coupling guard, 150 mm dia pressure gauge with GM isolation cock, suitable vibration eliminator pad of approved design. Motor to be suitable for including all necessary piping, valves and other accessories and concrete foundation complete as required. (1 Working + 1 Stand-by oras required).

d) SLUDGE DISPOSAL PUMP PUMPSET

Quantity	:	1 Set (1W + 1S) oras required
Type	:	Screw, Horizontal
MO Cof Body / Impeller	:	CI/ Bronze
Drive	:	V- Belt
Direction of Rotation	:	Clockwise
Capacity	:	As Required
Head	:	As Required
Solid Handling Capacity	:	Sludge- STP
Motor Rating	:	As required fulfilling technical parameters

e) FILTER FEED PUMPSET

Quantity	:	2Nos.(1W +1S) oras required
Type	:	Monoblock. Centrifugal with Mech. Seal
MO Cof Body / Impeller	:	CI/ Bronze
Capacity	:	As Required
Head	:	As Required
Solid Handling Capacity	:	As Required

MotorRating	:	As required fulfilling technical
Parameters		

iii) **AIRDIFFUSION SYSTEM**

a) **AIRBLOWER**

Quantity	:	2Nos.(1W +1S) oras required
Type	:	TwinType Rotary
MOCofofBody	:	CastIron
Drive	:	V- Belt
Direction of Rotation	:	Clockwise
Suction Silencer with AirFilter	:	Yes
Pressure Gauge / ReliefValve	:	1Each
Capacity	:	As Required
Discharge Pressure	:	As Required
MotorRating	:	As required fulfilling technical
Parameters		

b) **AIR DIFFUSER**

Type	:	Fine Bubble Tube Aerator
Air Transfer Capacity	:	3- 5cfm oras required
Length ofDiffuser	:	1000mmorasrequired
Dia.ofDiffuser	:	63mmoras required
Connection Size	:	20mmoras required
MOCofofMembrane	:	HighGrade EPDM oras required
MOCofofPipe Support	:	SS/ EPDMoras required
Fitting Material	:	PVCShaddle

iv) **MEDIA**

a) **FLUDISED MEDIA (ForAerationTank)**

Quantity	:	As Required or required
quantityas per capacity ofSTP selected		
Type	:	Random Bio Media
MOCofofMedia	:	VirginPPwith UVStabilized
Specific Surface AreaofMedia	:	160.0SQM/ CUMorasrequired
Protected Surface AreaofMedia	:	102.4SQM/ CUMorasrequired

b) **TUBE PAC MEDIA (For Tube Settler)**

Quantity	:	3 CUMoras required
Type	:	Hexagonal Chevron Shape Self
Supporting		
MOCofofMedia	:	VirginPVC,UV Stabilized

v) **TERTIARY TREATMENT (As per Requirements)**

a) **DUAL MEDIA FILTER**

Quantity	:	1No oras required
Capacity	:	As Required
WorkingPressure	:	3.0kg/cm2orasrequired

Type	:	Down Flow
MOC of Vessel	:	MSIS- 226DulyPainted
Thickness of Shell / Dish	:	8/ 10mm or as required
Thickness of Dish Plate	:	6mm or as required
Diameter	:	1750mm or as required
Height of Straight	:	1500mm or as required
Distribution System	:	Dish Plate with PVC Nozzles
Controls	:	Frontal Piping with Butterfly
Valves		
Frontal Piping	:	MS Welded
Manhole / Handhold Cover	:	1 Each
Air / Drain Valve	:	1 Each
Pressure Gauge / Sampling Cock	:	1 Each
Filter Media		

River mesh sand supported coarse sand and fines sand.

b) ACTIVATED CARBON FILTER

Quantity	:	1 No. or as required
Capacity	:	As Required
Working Pressure	:	3.0 kg/cm ² or as required
Type	:	Down Flow
MOC of Vessel	:	MSIS- 226 Duly Painted
Thickness of Shell / Dish	:	8/ 10mm or as required
Thickness of Dish Plate	:	6mm or as required
Diameter	:	1750mm or as required
Height of Straight	:	1500mm or as required
Distribution System	:	Dish Plate with PVC Nozzles
Controls	:	Frontal Piping with Butterfly
Valves		
Frontal Piping	:	MS Welded
Manhole / Handhold Cover	:	1 Each
Air / Drain Valve	:	1 Each
Pressure Gauge / Sampling Cock	:	1 Each
Filter Media		

River mesh sand supported coarse sand and Granular Activated Carbon 1000 IV.

c) ULTRA VIOLET UNIT (As per Requirements)

Quantity	:	1 No. or as required
Requirements		Capacity as per Requirements
MOC Reactor	:	Stainless Steel 316L
MOC Quartz Jacket	:	High Purity Quartz (UVT >95%)
UV Dosage	:	60 mJ/cm ² (65% UVT)
Voltage	:	220-240V/ 50- 60Hz
End Connection	:	65mm or as required
Max. Operating Pressure	:	80 psig or as required
Max. Operating Temperature	:	45 Degree C
Control Panel Rating	:	IP54
Control Panel MOC	:	Sheet Steel with Electrophoretic Dipcoat
Priming and Textured Powder Coating	:	Ballast Type : Electronic with Programmed Soft Start
Lamp Replacement Reminder	:	Yes

LampRunningHourCounter	:	Yes
Lamp Failure Indication	:	Yes
UV MonitoringSystem	:	Yes

d) SLUDGE DEWATERING FILTER PRESS

Quantity	:	1No.
Type	:	Hydraulic
Type of Element	:	P.P.Recess
Type of Delivery	:	Slide &Open
Closing Device	:	Motorized
Drainage Surface	:	Pips
Plate Size	:	300X300(mm)
No ofRecess Chamber	:	18Nos.
OperatingPressure	:	3– 5Kg/Cm2
Max.Operating Temp.	:	80Deg.C
Filter Cloth	:	1Set

vi) INSTRUMENTATION

a) LEVEL INDICATOR &CONTROLLER

Quantity	:	2Setoras required
Dimension	:	As Required within CCT&FWT
Type	:	Electronic
High/ Lowlevel Alarm	:	Yes AuxiliaryNO/NC

b) AIRFLOW METER

Quantity	:	2Nos.
Type	:	Vertical - Rotameter
MOCofBody	:	HighGrade Acrylic
Capacity	:	20M3/Hr.
OperatingTemperature	:	Ambient
OperatingPressure	:	6PSI
MOCofFloat	:	SS316

c) WATER FLOW METER

Quantity	:	1No. or as required
Type	:	Electromagnetic
Capacity	:	15M3/Hr.oras required
OperatingTemperature	:	Ambient
OperatingPressure	:	6PSIoras required
Connection Size	:	50mmoras required
MOCof Connection	:	SS

d) pH METER

Quantity	:	1No. or as required
Type	:	Flow Through / Tank
(Optional)		
Sensor O/P	:	Milli Volt
Application / Fluid	:	TreatedSewage
Range	:	00.00– 14.00pH

e) ENERGYMETER

Quantity	:	1No. or as required
Type	:	Electronic
Range	:	10– 40 Amps.

f) INTERCONNECTING PIPE & FITTINGS

PIPING

Submerged Air Pipe Line	:	SS304
Diffuser Line	:	Flexible
Air Line	:	MS Epoxy Painted
Effluent & Submerged Water Pipe Line	:	PVC Heavy Class
Water Line	:	MS Duly Painted
Pipe Class	:	Medium Class
MO Co Fittings	:	As Required

g) ELECTRICAL WORK

ELECTRICAL CONTROL PANEL

Quantity	:	1 Set or as required
Fabrication Material	:	14 Gauge CRCA Sheet Steel duly
Anticorrosive Paint & Powder Coated Gland Plate: Top & Bottom	:	
Description	:	As required
Electrical Accessories	:	ISI Approved

h) CABLE & CONDUITING

Quantity	:	1 Lot within Plant Room
Type	:	Flexible – Triple Layer ISI Marked

35. EFFLUENT TREATMENT PLANT:-

- i. The effluent generated namely from the Laboratories Areas etc. shall be disposed by gravity system into the effluent treatment plant. After treatment in the ETP, the discharge shall be connected to the Equalization tank of STP.
- ii. In ETP, Flocculator, Flash Mixer & Chemical dosing system should be proposed for preliminary treatment of Labs effluent after which semi treated water will be treated through the entire STP Plant.
- iii. Effluent Treatment Plant of suitable Capacity shall be provided to meet the specified outlet parameters of water. ETP shall comprise of bar screen chambers, flash mixer, level sensors, instruments, interconnecting piping {PVC piping (10kg/sqcm)- For all submerged waste water piping, MS (C Class) - For all exposed air piping and flexible stainless steel pipe for submerged air piping. GI (C class) for all other water piping }, valves, tube settler, media in tube settler, chlorine dosing, pressure gauges, instruments, level sensors, non-clogging mono-block pumps of suitable capacity & head, lime/alum/polyelectrolyte dosing system consisting of ABS dosing pump with suitable capacity HDPE tank including all piping from the dozer to the reaction tank etc. control panel, high speed Agitator of SS 304 and Flocculator complete with single phase motor for flash mixer, electrical wiring, etc. complete including all necessary safety requirements.

36. SOLAR WATER HEATING SYSTEM

36.1. Design, Engineering Supply, Installation, Testing & Commissioning of Solar Water Heating system shall be carried out by the Contractor on EPC Basis & as directed by Engineer-in-charge.

36.2. Solar water heating (SWH) is the conversion of sunlight into renewable energy for water heating using a solar thermal collector.

36.3. For Academic Building Close Coupled Solar Hot Water System coupled with Heat Pumps shall be used. In a "close-coupled" SWH system the storage tank is horizontally mounted immediately above the solar collectors on the roof. No pumping is required as the hot water naturally rises into the tank through thermo siphon flow. Solar water heating system produces hot water at a temperature of 60 Deg. C and In accordance with the IS-12976:1990 and IS-12933:1990 (Part 1 to part 5). Solar hot water system may be with recirculation pump & heat exchanger system, pump to supply water from raw water storage tank to solar storage tank if height of storage tank is higher than raw water storage tank. System to ensure that the solar hot water generated during the sunshine hours of the day is stored in a Solar Insulated tank (Heat Bank) & then the Heat is transferred to the Mixing tank as & when required (HTC application), so that the Hot water is made available at the Controlled Temperature for final usage.

36.4. In other buildings, conventional Solar Hot Water System shall be used without any recirculation pumps. It supplies the hot water by gravity as a preheated water to the electric geysers at all user points

36.5. **Testing:** All G.I pipes of Primary Circuit (Collector Circuits) shall be tested to hydrostatically for a period of 30 minutes to a pressure of 2 kg/Sq.cm without drop in pressure and all other G.I pipes for a pressure of 6 Kg/Sq.cm.

36.6. HOT WATER STORAGE TANK

i. SS-316 horizontal/vertical hot water storage tank with the required thickness (as Required) to withstand working pressure of 5 kg/sqcm. The hot water storage tank is provided with a manhole, cover, drain, vent, overflow, inlet and outlet connections etc as required and as per direction of Engineer in Charge.

ii. Each hot water storage tank shall be provided with the following:

iii. Thermostatic control valve

- a) Safety valve
- b) One AIR Release valve
- c) Pressure and temperature relief valve
- d) High limit Temperature sensor
- e) Primary flow connection
- f) Hot water supply connection
- g) Hot water return connection
- h) Drain connection
- i) Thermometer fitted (inserted) in thermo well
- j) Pressure gauge
- k) Make up tank
- l) Ball valve

- iv. The hot water storage tank shall be hydrostatically tested to one and half times the working pressure of a system for a period of 24 hours without any leak. Field tests are to be performed at site to satisfy the capacity and operation of the unit by the Engineer-in-charge / CPWD/project in-charge.

36.7. PIPING

36.8. HOT WATER PIPING

Supply and return pipes of the hot water system complete with necessary pipes, bends, flanges, fittings, gaskets and valves are to be provided to connect Solar water heating system, hot water storage tank. The hot water supply and return pipes are insulated with Rock wool and clad with aluminium sheets of 24SWG.

36.9. HOT WATER SOLAR PIPING

- i. GI/CPVC/UPVC solar hot water piping complete with bends, flanges, fittings, gaskets and valves to connect the solar panels to the hot water storage tank with necessary valves and fittings.
- ii. This also includes the solar circulation pumps as per requirement to circulate the hot water to the tank from the solar panels.
- iii. The hot water piping insulated with Rock wool and clad with aluminium sheets.

36.10. PIPE INSULATION

Pipe insulation shall be as required under "HOT INSULATION".

36.11. INSTALLATION

- i. Pipe installation shall be carried out with proper workmanship in accordance with approved drawings/ Engineer in Charge. Pipe shall be aligned parallel to walls and ceiling and not across the room. Change of direction shall be through hydraulically formed welding fittings as specified. Alignment shall follow the approved drawings/ Engineer in Charge and wherever necessary pipe shall be rerouted under the instructions of Engineer in Charge in order to meet the site conditions and or interference from other services.
- ii. Additional supports shall be provided at the bends, at heavy fittings like valves, near equipment and as directed by Engineer in Charge. Pipe hangers shall be from structural steel, steel inserts in concrete, wall brackets or floor supports as decided by the Engineer in Charge depending upon the location of the support. Hangers shall not be secured to light weight roof, wall, false ceiling or any other member which is not structurally meant for such loading. Hangers from structural steel shall be from suitably designed clamps or attachments and in no case should drilling or punching of such steel members be allowed. All pipe supports shall be capable of being adjusted in height to the tune of 50 mm.
- iii. Pipe clamps shall be specially fabricated fittings for pipes. All clamps shall be of galvanized steel and finish coated with matt black paint. Clamps shall take into account pipe movement owing to temperature variations & anchors, and

in no case shall the clamping arrangement induce stresses beyond the safe load limits of the pipe under fully filled conditions. Where pipes are insulated, the clamping shall interpose a hard insulation material or shall be designed so that the insulation is not compressed for more than 60 % of its compression strength.

- iv. Vertical pipe risers shall be supported at each floor and in addition, the riser shall have a duck-foot support.
- v. All pipe joints shall be welded except where flange joints are specified hereinafter. Pipes upto 40 mm NB shall use socket - weld fittings of 150 lbs rating with fillet welding and larger sizes shall used with butt-welding type single V 35 deg weld preparation. Flange joints shall be provided at the following positions:
 - a) Pair of flanges for isolation of equipment
 - b) Mating flange for equipment flange connections
 - c) Mating flange for valves, strainers as the case may be
 - d) Pair of flanges at every 40m continuous run of piping
- vi. All piping shall be laid and tack welded in position with flanges, valves etc. After inspection and approval by the Engineer in Charge as to the alignment and height, the piping shall be full welded. Piping may be presented for such approval in sections. Slip-on flanges shall be demounted for welding.
- vii. Random samples of valves shall be tested for leaks and seating. Necessary hand pump and blank flange facilities with pressure gauge, valves etc. should be provided at site.
- viii. All pipe insulations shall be carried out in sections after duly testing.

36.12. TESTING

Piping shall be hydrostatically tested to 1.5 times more than the rated pressure for a minimum period of 24 hours without any leak and loss of pressure.

36.13. MODE OF MEASUREMENT

- i. All piping shall be measured along the centre line of pipe laid inclusive of all fittings but excluding valves and flanges and the same shall be paid as per unit rate indicated in the bill of quantities.
- ii. A pair of flanges with gasket, bolts and nuts shall be measured per unit.
- iii. Single flanges for mating with equipment complete with gasket, bolts etc. shall be measured as 60 % of the above.
- iv. All valves shall be measured per unit.
- v. Any fabricated structural systems shall be measured on the basis of estimated weight of structural steel members excluding the bolts and nuts welding etc.

36.14. SOLAR COLLECTOR PANELS

- i. The scope of work covers supply, erection, testing and commissioning of the Solar Collector Panels meeting the requirements and the intent of this specifications.
- ii. Manufacturer's catalogues and guaranteed performance details to be submitted for Approvals before ordering the supply of the equipment.
- iii. Collector:

Type: copper type with minimum size of 2sqmtr of each type.

i) CollectorFrame	Extruded	-	Aluminium1.4mmthickoras required
ii) Gasket forGlass (Beading)		-	EPDM"U" Type
iii) Glazing(Cover)		-	Toughenedclearglass
iv) CollectorBody		-	Aluminum
v) Bottom Insulation		-	40mmRockwool (Minimum)
vi) Side Insulation		-	20mmRockwool(Minimum)
vii) Absorber Plate		-	Copper
ix)Riser Copper		-	Dia- 12.7mm oras required
x) Inlet Header Copper		-	Dia- 25.4mmoras required
xi)Reflective Foil		-	Aluminiumorasrequired
xii) Grommet		-	EPDMoras required
xiii) CollectorBacksheet		-	Aluminiumorasrequired
Absorber area		-	2Sq. Mtr.oras required
No.ofRisertubes per collector		-	9per collector
No.of Absorber Plateper collector		-	9 per collector
Glazingtransmissivity	> 80%		
Coating absorptivity	> 0.90		
Coating emissivity	< 0.20		
Absorber riserbonding	Ultrasonic/LaserWelding		
Collectorefficiencyatambienttemp.	> 65%	oras required	
Finish	-(PowderCoating)Goldenyellowforframe,BlackforGlassretaining angle		
WorkingPressure	-5Kg./cm2oras required		
Operating Conditions	T > 50deg.Coras required		

36.15. COLLECTOR SUPPORT FRAME

- i. The structure should be in a position to withstand a wind velocity of 100 Kms/hr. It shall be made of angle iron 40mm x 40mm x 5mm and shall have vertical support at top and bottom edge of the inclined plane of the collector at a distance of 2.5m or less. The vertical supports shall be firmly grouted to the roof in the ground in case of ground mounted system. The grouting blocks shall be of minimum equal to 250mm x 250mm x 150mm and finished properly. In case the grouting is carried out on roof already waterproofed with asphalt the back support of the collectors may be anchored to the parapet or the size of the grouting block shall be increased to provide for a dead weight anchoring of 75kg per leg of the vertical support. Any other alternative method of grouting/supporting shall be submitted with documents to Engineer-In-Charge / Project In charge for their approval prior to execution.

36.16. ABSORBER

- i. The absorber shall consist of riser, header and sheet for absorber. The diameter of header shall be 25.4 mm and Thickness 0.71 mm. The diameter of the riser shall be 12.7 mm and thickness 0.56 mm and made of copper only. The distance between the riser from centre to centre shall be 120 mm. Type, Grade, Size, Workmanship and Finishes shall be as per IS: 12933. The riser and header pipes shall be of copper. The welding between Copper tube riser and Copper Sheet should be Laser-Welding or Ultrasonic-Welding
- ii. The sheet shall be coated with selective coating to satisfy solar absorption of more than 0.90 & solar emissivity < 0.12. or as required.

- iii. The selective coating shall not get damage when the sample is raised to 1250C temperatures.
- iv. All tests such as solar absorption test, emissivity test and temperature tests are to be carried out as per standard tests.
- v. Riser and header assembly designed for working pressure up to 2.5 Kg/cm² and shall be tested for leakage at the Min. hydraulic pressure of 3.5 kg/cm².
- vi. Sheet for absorber shall be made of copper only.

36.17. STAND

- i. The stand for the collector and hot water storage tank are to be designed taking into consideration the load to be carried by the stand. The collector becomes vulnerable to wind dust. The collector may be up-listed by wind striking the underside. This wind load should be determined according to accepted engineering practices and procedures. The material for collector stand shall be of size 32x32x3mm M.S. Angle iron with one coat of red oxide primer and two more coats of enamel paint.

36.18. SOLAR HEAT BANK TANK

The material of the Solar Heat Bank shall be MS Sheet. & capacity shall be 10,000 Liters. The thickness of the Solar Heat Bank Tank shall be 6 mm shell and 8 mm dish ends. The tank shall have a Manhole of dia. min. 450mm & have a special layer of Resin Bonded Fibreglas Coating inside the tank to prevent corrosion. The tank shall be semi-pressurized type with air vents

36.19. SOLAR MIXING TANK

The material of the Solar Mixing Tank shall be SS-304 Sheet. & capacity shall be as per requirements. The thickness of the Mixing Tank shall be 3mm shell and 4 mm dish ends. A special layer of QUARTZ coating inside the tank to prevent corrosion shall be provided. The tank shall be non-pressurized type with air vents

36.20. TANK INSULATION

Both the Hot Water Tanks shall be insulated with 100 mm thick rock/glass wool of 48 Kg/m³ of density & clad with 24 SWG Aluminium cladding.

36.21. PLATE HEAT EXCHANGER

The Plate Heat Exchanger for Heat Transfer & Control (HTC) application shall be made of SS-316 plates. The capacity for heat transfers should be as per requirements.

36.22. SYSTEM INTERCONNECTING PIPING

G.I. Pipe of Medium class as per IS: 1239 duly insulated with 13mm Nitrile Tube & clad with polyshield outer mechanical protection on nitrile rubber insulation, comprising of wrapping with poly-glass tape helically wound and subsequently applying 2 coats of polyshield material (resin & hardener) as per manufacturer specification and approved by Engineer-in-charge.

36.23. MAKEUP TANK

The capacity of Makeup tank for solar circuit shall be 200 Ltr. or as required complete with float valve and interconnection piping as required. Soft water is to be provided for the makeup tank by Engineer-in-charge

36.24. ELECTRICAL HEATER

Electrical Heaters shall be ISI Marked. Electrical heaters shall be of 12 nos. each of rating 5KW for the 5000 Liter Mixing Tank as required.

36.25. ELECTRICAL HEATER CONTROL PANEL

The Electrical Heater System shall be split in 2 zones of 30KW each or as required & shall be having Thermo-Sensor based operation. Electric Heater Control Panel of total 60kW rating shall be part of the main Control Panel as the Heater Control Zone.

36.26. PUMPS for FORCED CIRCULATION, HTC & RE-CIRCULATION OPERATIONS

All Pumps used in the solar system for Forced Circulation, HTC & Re-Circulation Systems shall be Horizontal type with Centrifugal operation & having SS Impeller & Shaft and with CI Body. All Pumps shall be suitable for 3- Phase Operation & shall be for 1 Working & 1 Standby mode.

36.27. CONTROL PANEL for PUMP OPERATION

The Operation of the Pumps in the above operation shall be DOL Starter based with adequate rating. The Main Control Panel shall be subdivided into sub-Zones for following operations

- a) Forced Circulation Zone
- b) Heat Transfer & Control Zone (for Primary & Secondary Pump sets)
- c) Hot Water Re-Circulation in Building Zone

Note: Contractor shall provide Control Panel with makes as specified in the list of approved makes with digital differential temperature controller / PLC including necessary electronic parts like Contractors, Relays, Indicators, MCBs, Control fuses etc. for satisfactory working of pumps.

vii) TEMPERATURE GAUGE

DIAL Type temperature gauge duly calibrated and suitable for temperature range 0-120 deg. Celsius shall be provided.

Contractor shall provide all valves, strainer, float valves and NRV etc. as per requirement.

Contractor shall provide 1:2:4 cement concrete foundation of size

300x300x250 mm (1 cement: 2 coarse sand: 4 stone aggregate of size 20 mm nominal size) for each and every footing of system. This will be scope of Civil

Contractor with complete guidance from Solar Contractor.

a) Painting of stands

Proper cleaning and degreasing of the surfaces should be done before painting. Two coats of zinc chromate red oxide primers shall be applied followed by one coat of epoxy paint and approved colour recommended by the Engineer-In-Charge / CPWD.

b) Piping

- Material : Medium class (B class) Galv per IS 1239 shall be used for piping.
- Back insulation: Insulation of R value = 1.67 m²°C/W to withstand a temperature of 100°C shall be used.

c) Sr. Trade Name K Kg/m³ R Minimum No. (W /mk) Thickness

1 Spintex – 300 0.029 48 1.67 50mm (Rockwool)
Thin plasticsheet shall be used as covering between glass wool and aluminum cladding besides other retaining material like chicken mesh etc.
24SWG aluminium sheet shall be used for cladding the insulated pipe.

d) Valves /Nipple /Tees/Bends

Gun metal valve as per IS 780 specifications shall be used.
Nipple / Tees and bends shall be of Glass per IS 1239 Part II.
Gun metal ball valve shall be provided in each row outlet with Air vent.

36.28. VALVES

Gate valves or butterfly valves for shut-off or sectionalizing service, globe or ball valves for flow modulation. For on-site control, use gate valves. Specialty valve shall be employed where appropriate, such as check valves on a pump discharge, pressure regulating valves for equipment requiring lower-than-available system pressure, solenoid valves, etc. Flanged or threaded end valves are preferred. Locate valves in accessible locations, not more than six feet above the floor, if frequently used, and with a union on the downstream side of threaded end valves.

Provide each valve with brass, aluminum or plastic disc not less than 32mm diameter engraved with numbers, piping service and normal operating position (i.e. NO, NC) corresponding to valves shown on the diagram. Fasten disc to valve with 14 gauge brass wire or 16 gauge jack chain.

36.29. GATE VALVE

- i. The primary function of a gate valve is for starting and stopping of flow. It has a disc actuated by a stem screw and hand wheel, moves up and down at right angles to the path of flow of fluid and seats against two faces to shut off flow. As the disc of the gate valve presents a flat surface to the direction of flow, this valve is only for starting and shutting the flow in the pipe.
- ii. These valves are of Gun Metal (GM) make. Supplying, fixing and testing correspond to IS 778-1984, Specifications for Copper Alloy Gate, Globe and Check Valves for Water Works.
- iii. All globe and check valves shall have working parts suitable for hot and cold water, as required. Valves shall be tagged with permanent label under hand wheel indicating type or duty.
- iv. All valves should have manufacturer's test certificate indicating the date of shop test and other quality control tests with the material used for the same.

36.30. BALL VALVE

The ball valve shall be of high-pressure type and shall be of sizes as specified and/or shown in the drawings the normal size of a ball valve shall be that, corresponding to the size of the pipe to which it is fixed. Ball valves shall have body of carbon steel. The ball and the shaft shall be of stainless steel. The seat shall be of PTFE. The valve shall be complete with socket weld ends and the float of copper sheet. The minimum thickness of copper sheet used for making the float shall be 0.45mm for a float exceeding 115mm dia. The body of the high-pressure ball valve when assembled in working condition with the float

immersed to not more than half of its diameter shall remain closed against a test pressure of 3.5kg/sqcm.

The ball valve shall generally conform to IS specification No.1703: 1977. The weight of ball cock and the size of the ball cock shall be as per IS specification.

36.31. System LayoutAnd Design

- i. Maximum number of collector in series shall be not more than Ten for Thermosyphon system and not more than 15 for force circulation system.
- ii. Maximum number of collector in parallel in one row with header to header connections should not be more than Six.
- iii. Air venting at appropriate places without hindrance of a spring loaded valve to prevent air locking in the system should be provided. For this purpose system shall have at a suitable point atmospheric pressure conditions preferably in the high temperature zone.
- iv. Flow rates commensurate with optimum heat removal from collector plates.
- v. System shall have a suitable expansion / make up tank at a high point in the system to ensure that collectors run full all the times. Capacity of this expansion make up tank should be 1% of the system capacity. For all systems above the capacity of 5000 LPD and 1.5% of the system capacity for the systems of capacity ranging from 1000 LPD to 5000 LPD.
- vi. Expansion cum make-up tank is for closed loop system and make up tank is for open loop system.

36.32. HEATPUMPS

- i. The Packaged type Air to Water Heat Pump. shall be completely factory assembled including 2 Nos. Scroll Hermetically Sealed Scroll / Reciprocating Compressor(s), evaporator, Condenser and Microprocessor Control Panel etc with R134a / 410 a Refrigerant and COP between 3-4. The Heat Pump shall have inbuilt hot water heat exchanger, vibrationisolators, pumps, valves, expansion valve, Copper / Aluminium fins, and other accessories. The Heat Pump should be capable of producing hot water at minimum 55°C temperature at outlet (condenser circuit) temperatures at approx. 40°C ΔT. The Machine
- ii. should have an operating ambient temperature range of 0°C to 40°C.
- iii. Heat Pump shall have built in electric panel as per safety norms as manufacturer standard. It shall be Suitable for electric supply of 415 + 10% volts & 50 Hz. The Heat pump shall have an in-built facility to start / stop depending on variation in demand at different periods. All interconnecting wiring / cabling between heat pump and electrical panel shall be part of the equipment.
- iv. The Heat Pumps shall be installed in N+1 condition at terrace level of hospital building.

37. TECHNICALSPECIFICATIONS-RO PLANT

37.1. SCOPE OF WORK

Work shall consist of furnishing all labour, materials, equipment and appliances necessary and required. The Contractor is required to completely furnish all the plumbing and other specialized services as described hereinafter and as specified in the schedule of quantities and/or shown on the plumbing drawings for RO Plant

37.2. SPECIFICATIONS

- i. Work under this Contract shall be carried out strictly in accordance with specifications attached with the Bid.
- ii. Items not covered under these specifications or due to any ambiguity or misprints, or additional works, the work shall be carried out as per specifications of the latest Central Public Works Department with up to date amendments as applicable in the Contract.
- iii. Works not covered under Paragraphs above shall be carried out as per relevant Codes & Bureau of Indian Standards and in case of its absence as per British Standard Code of Practice.

37.3. EXECUTION OF WORK

- i. The Contractor should visit and examine the site of work and satisfy himself as to the nature of the existing roads and other means of communication and other details pertaining to the work and local conditions and facilities for obtaining his own information on all matters affecting the execution of work.
- ii. The work shall be carried out in conformity with the Plumbing drawings and within the requirements of architectural and coordinated with all services drawings.
- iii. The Contractor shall cooperate with all trades and agencies working on the site. He shall make provision for hangers, sleeves, structural openings and other requirements well in advance to prevent hold up of progress of the construction schedule. All supports to the civil structure shall be provided with dash fasteners.
- iv. On award of the work, Contractor shall submit a schedule of construction in the form of a PERT chart or BAR chart for approval of the Engineer-In-Charge. All dates and time schedule agreed upon shall be strictly adhered to within the stipulated time of completion/commissioning along with the specified phasing, if any.

37.4. DRAWINGS

- i. Bid drawings/Schematic of RO system is provided to the Contractor. On the basis of these, shop drawings will be prepared & submitted to Engineer-in-charge for approval. The execution of work shall be done in-line with the approved shop drawings.
- ii. Architectural drawings shall take precedence over plumbing or other services drawings as to all dimensions.
- iii. Contractor shall verify all dimensions at site and bring to the notice of the Engineer-In-Charge all discrepancies or deviations noticed. Decision of the Engineer-In-Charge shall be final.
- iv. Large size details and manufacturers dimensions for materials to be incorporated shall take precedence over small scale drawings.
- v. Any drawings issued by the Engineer-in-charge for the work are the property of the Engineer-in-charge and shall not be lent, reproduced or used on any works other than intended without the written permission of the Engineer-in-charge.

37.5. REFERENCE DRAWINGS

- i. The Contractor shall maintain one set of all drawings issued to him as reference drawings. These shall not be used on site. All important

drawings shall be mounted on boards and placed in racks indexed. No drawings shall be rolled.

- ii. All corrections, deviations and changes made on the site shall be shown on these reference drawings for final incorporation in the completion drawings to be submitted by the contractor in fulfilment of the conditions of this contract.
- iii. On award of the work the contractor shall be issued, one set of working drawings stamped "Bid drawings" by the Engineer-In-Charge. The working drawings shall be on the basis of contractor's shop drawings. Upon submission of shop drawings to Engineer-In-Charge, Final approved drawings will be stamped as "Good for Construction" drawings, based on which execution work will be done.
- iv. Shop drawings are detailed working drawings which incorporate the contractor's details for execution of the work and incorporate equipment manufacturer's details and dimensions to ensure that the same can be installed in the space provided.
- v. All shop drawings should detailed pipe routing and levels, showing location of other services at crossings etc., cable runs, route cable trays and all allied works and must be fully coordinated with other services and approved by the Engineer-In-Charge before execution of the works. Engineer-In-Charge shall arrange to issue one copy/print of services drawings (if required for coordination of services) from the respective contracting agencies. Additional copies/ prints may be provided on payment of actual cost of the copies/ prints. All drawings will valid only when stamped and issued by the Engineer-In-Charge.
- vi. Shop drawings shall be furnished for detailed layout of all equipment, foundation, bolting and vibration elimination details along with information on dead and dynamic load, vibration etc.
- vii. Two sets of manufacturer's equipment drawings, roughing in and wiring diagrams shall be submitted.
- viii. Contractor shall submit shop drawings furnishing all details of MCC panels, cable routes, wiring diagrams and connection details as required.
- ix. Two copies of each set of shop drawings shall be submitted for initial scrutiny, discussion and approval.
- x. Each submission shall be accompanied by contractor's certificate stating that the shop drawings meet all the contract requirements and that the piping and equipment can be satisfactorily installed without any obstructions in the space available.
- xi. On approval of the above the contractor shall furnish three sets of the approved shop drawings for execution of the work.

37.6. INSPECTION AND TESTING OF MATERIALS

- i. Contractor shall be required, if requested, to produce manufacturers test certificate for the particular batch of materials supplied to him. The tests carried out shall be as per the relevant Bureau of Indian Standards.
- ii. For examination and testing of materials and works at the site Contractor shall provide all testing and gauging equipment necessary but not limited to the following:
 - a) Steel tapes
 - b) Weighing machine
 - c) Plumb bobs, spirit levels, hammer
 - d) Micrometers
 - e) Hydraulic machine

- iii. All such equipment shall be tested for calibration at any approved laboratory, if required by the Engineer-In-Charge. All testing equipment shall be preferably located in special room meant for the purpose.
- iv. Samples of all materials shall be got approved before placing order and the approved samples shall be deposited with the Engineer-In-Charge.

37.7. METRICCONVERSION

- i. All dimensions and sizes of materials and equipment given in the Bid document are commercial metric sizes.
- ii. Any weights, or sizes given in the Bid having changed due to metric conversion, the nearest equivalent sizes accepted by Indian Standards shall be acceptable without any additional cost.

37.8. COMPLETION DRAWINGS

- i. On completion of work, Contractor shall submit one complete set of original tracings and six prints of "as built" drawings. These drawings shall have the following information.
- ii. Run of all piping, diameters on all floors, vertical stacks and location of external services.
- iii. Ground and invert levels of all drainage pipes together with location of all manholes and connections up to outfall.
- iv. Run of all water supply lines with diameters, locations of control valves, access panels.
- v. Layout showing location of all mechanical equipment and piping connections.
- vi. All shop drawings shall be updated from time to time for the purpose of making completion drawings.
- vii. No completion certificate shall be issued unless the above drawings are submitted.
- viii. Contractor shall provide four sets of catalogues, service/operation & maintenance manuals, manufacturer's drawings, performance data and list of spare parts together with the name and address of the
- ix. manufacturer for all electrical and mechanical equipment provided by him.
- x. All "warranty cards" given by the manufacturers shall be handed over to the Engineer-In-Charge.

37.9. TESTING

- i. Piping and drainage works shall be tested as specified under the relevant clauses of the specifications.
- ii. Tests shall be performed in presence of the Engineer-In-Charge and test records for the tests shall be duly signed by Contractor and the Engineer-In-Charge.
- iii. All materials and equipment found defective shall be replaced and whole work tested to meet the requirements of the specifications.
- iv. Contractor shall perform all such tests as may be necessary and required by the local authorities to meet municipal or other bye-laws in force.
- v. Contractor shall provide all labour, equipment and materials for the performance of the tests.

37.10. SITECLEARANCEAND CLEANUP

- i. The Contractor shall, from time to time, clear away all debris and excess materials accumulated at the site.

- ii. After the fixtures, equipment and appliances have been installed and commissioned, Contractor shall clean-up the same and remove all plaster, paints, stains, stickers and other foreign matter or discolouration leaving the same in a ready to use condition.
- iii. On completion of all works, Contractor shall demolish all stores, remove all surplus materials and leave the site in a broom clean condition, failing which the same shall be done by the Engineer-In-Charge at the Contractor's risk and cost. Cost of the cleanup shall be deducted from the contractor's bills on pro-rata basis in proportion to his contract value.

37.11. LICENCE PERMITS AND AUTHORITIES

- i. Contractor must hold a valid plumbing or any other as required license by the municipal authority or other competent authority under whose jurisdiction the work falls.
- ii. Contractor must keep constant liaison with the local development, municipal /statutory authority and obtain approval of all drainage, water supply, fire suppression and other works carried out by him.
- iii. Contractor shall obtain, from the municipal and other authorities 'C' & 'D' & other forms as required for approval of drainage and water supply works during execution and the completion certificate with respect to his work as required for occupation of the building. Contractor shall obtain permanent water supply and drainage connections from authorities concerned. Engineer-In-Charge shall reimburse the fees paid to the authorities towards the connection charges on production of receipts for money paid.
- iv. Contractor shall get any materials tested from the appropriate authority if so required with no cost to the Engineer-In-Charge.

37.12. CUTTING OF WATER PROOFING MEMBRANE:

No walls terraces shall be cut for making and opening after water proofing has been done without written approval of Engineer-In-Charge. Cutting of water proofing membrane shall be done very carefully so as other portion of water proofing is not damaged. On completion of work at such place the water proofing membrane shall be made good and ensured that the opening/cutting is made fully water proof as per specifications and details of water proofing approved by Engineer-In-Charge.

37.13. MATERIALS

- i. Unless otherwise specified and expressly approved in writing by the Engineer-In-Charge, only materials of makes and specification as mentioned in the list of approved makes attached with the specifications shall be used.
- ii. If required, the Contractor shall submit samples of materials proposed to be used in the works. Approved samples shall be kept in the office of the Engineer-In-Charge.

37.14. DESIGN BASIS:-

The central RO Capacity shall be of minimum 5000 LPH capacity for Hospital Building. In all other areas portable RO Water System shall be installed as per DBR

37.15. TREATED WATER QUALITY

- i. **Physical Quality**
 - a) Normally the RO water turbidity shall be less than 1 NTU.
 - b) The colour of the filtered water shall be restricted to 2 Hazen units on platinum cobalt
- ii. There shall be nothing objectionable as regards taste and odor
- iii. **Chemical Quality**
 - a) The pH value of filtered water shall be within 6.5 – 7.0
 - b) Other chemical quality parameters such as total dissolved solids should be less than 50 ppm
- iv. **Biological Quality**
 - a) Throughout the year, 100% of samples shall not contain any coliform organism in 100 ml.
 - b) Coliform organisms shall not be detectable in 100 ml of any two consecutive samples. No sample shall contain E – Coli in 100 ml.
 - c) The Output of RO Water should comply with the BIS 10500 for Drinking Water.
 - d) The RO membranes are embedded within the pressure vessel. One side of the membrane is enclosed within the brine seal to avoid the mixing of filtered water and inlet water. Each membrane is connected to the other by means of interconnect or, and has a common permeate end. The filtered water is collected from the permeate end is sent to drinking and cafeteria usage.

37.16. Components & specification of Centralized RO Plant are mentioned hereunder:-

- i. **RO High Pressure Feed Pumps (HPP)** of Vertical multistage centrifugal type and suitable head to generate permeate flow. The pump casing construction shall be of SS-316 & impellers shall be also SS316. The motor shall be TEFC with IE-3 efficiency suitable for a supply of 415V/3 Phase at 50 Hz. Supply. The pump shall be supplied complete with base channel, coupling foundation bolts, pressure gauge, valves at inlet and outlet of each pump. (1 working + 1 Standby). RO high pressure pump is water feeding from treated water tank to RO module at high pressure flow.
- ii. **RO Raw Water Pumps (RWP)** of Vertical multistage centrifugal type and suitable head to generate permeate flow as Required. The pump casing construction shall be of SS-316 & impellers shall be also SS316. The motor shall be TEFC with IE-3 efficiency suitable for a supply of 415V/3 Phase/50 Hz. Supply. The pump shall be supplied complete with base channel, coupling foundation bolts, pressure gauge, valves at inlet and outlet of each pump. (Contractor to confirm duty for suitability). (1 working + 1 Standby).
- iii. **Package type RO module** capable of giving a net treated water output as required. The Reverse osmosis module shall be made out of Spiral Wound Thin Film Composites suitable BSPT/NPT connections shall be used for connecting feed and reject ends. The module shall be supplied complete with all necessary instrumentation, valves for sampling, drain, reject and permeate.
- iv. **Special Antiscalant dosing system** consisting of one HDPE tank of capacity as Required with a positive displacement diaphragm dosing pump having variable flow rate. The motor shall be suitable for operation at 240V/ single phase/50 Hz supply. The pump shall be supplied complete with necessary polypropylene piping, valves, strainers and injection fittings.
- v. **Micron cartridge filter** (shall be made of FDA compliant high quality

polypropylene material) suitable for a flow rate as Required to achieve particle filtration of less than 5 microns. The unit shall be supplied complete with inlet and outlet branches, removal caps for replacement of elements, inlet and outlet pressure indicator, valves etc. complete in all respect.

- vi. **CIP system (Cleaning in Place)** consisting of HDPE tank with agitator complete with inlet/outlet, drain overflow etc. along with SS pump of capacity as required and cartridge filter of 10 micron. The cartridge filter shall be made of FDA compliant high quality poly propylene material to achieve particle filtration of less than 10 microns.
- vii. **PH correction dosing system** consisting of one HDPE tank with a positive displacement diaphragm dosing pump having variable flow rate as required. The motor shall be suitable for operation at 240V/single phase/50 Hz supply. The pump shall be supplied complete with necessary polypropylene piping, valves, strainers and injection fittings.
- viii. **Centralized control panel** made out of CRCA sheet min. 2mm thick having main contactors for all pumps (listed above) including SPP, 3 phase thermal overload relay. The control panel for monitoring and control of RO system shall include all required signal lamps, HRC fuses, and Annunciation box with hooter. All control and power cabling along with double earthing between the panel shall be included in the scope of the contractor. An emergency stop push button shall be provided in the panel.
- ix. **High pressure side piping** from the RO high pressure pump to the rejects stream control valve shall be of SS 316 using all SS fittings ball valves of suitable pressure rating shall be used till 50 MM size, above 50 MM, flanged globe/water butterfly valves in SS construction shall be used. Rejects pressure control valve shall be globe valve and feed flow control valve shall be of SS
- x. **SS 316 RO Water storage tank** (Capacity as Required) of minimum 3mm thickness. Tank shall be provided with water flow meter at inlet & outlet, inlet/outlet valves, overflow/drain connection with MH cover (550mm I.D.) Tank shall be mounted on 450mm high steel structural supports with access ladder painted with 2 coats of red oxide paint.

37.17. ELECTRICAL AND INSTRUMENTATIONS

Control Panel: Fixed cubical type with weather proof DOL/Star Delta Starters (as per requirements) consisting of incoming feeder with outgoing feeder feeders, Voltmeters, Ammeter, push button with indicator lamp, overload relays, Contactors, Bus bar of required size, control cabling etc.

Type of panel: Compartment for individual feeder

MOC:

MS (1.6mm thick sheet) fabricated with powder coating.

Earthing Consist of Copper flats/copper wire of required size for earthing motors, MCC Etc. Required compression glands, ferrules, ties, aluminum etc.

Instrumentation Like level controllers, pressure switches, pressure gauges as required.

38. PORTABLE WATER PURIFIER

- i. Design, Supply, installation, testing & commissioning of Portable Water Purifier (RO+UV) of water flow rate 9-12 LPH with storage capacity of

min. 10 litres incl. RO membrane, pumps, motors, cartridge filters, interconnecting pipes, valves, cable etc. complete in all respects as per manufacturer's standards & as directed by Engineer-In-Charge.

- ii. **Materials:** The Portable Water Purifier shall have PP meltdown sediment filter, activated carbon **block**, thin film composite spiral wound type reverse osmosis membrane, ultra violet membranes, diaphragm type pump, suitable for maximum 500 ppm hardness, 10 NTU turbidity, TDS of max 2000 ppm inlet water quality & a reduction upto 90% in TDS & Hardness parameters. The purified water flow shall be approximately 9-12 LPH on average. The system shall be suitable for a supply of 100-240 V AC / 50 Hz. The Purifier shall be supplied with all equipment membranes, filters and pumps, motors, interconnecting pipes, adaptor and cable of minimum 1.8m length & complete in all respect.

39. ROAD WORK

39.1. The entire campus is almost undulated with sand dunes. The finished levels of internal roads and Buildings plinth shall be kept as per shown in Master Layout Plan.

39.2. The site is to be leveled and dressed in different level terraces as per levels decided in master layout plans. The existing site is with coarse sand dunes / undulated land with vegetation and trees. The trees shall be cut by forest department. The work shall be completed as per PIU/ Relevant Specification/Relevant Codes/ Relevant Circular/CPWD.

39.3. It is proposed to Construct the campus roads with filling/cutting of earth where ever is required as per finished road level fixed but existing dunes shall be kept at same levels with preparation of sub-grade by compaction at 97 % dry density. As per IRC code considering the minimum CBR value 5% the thickness of road required 45 cm to 50 cm (sub layer + base layer).

39.4. Two types of roads shall be constructed:

- i. Main road with 25 mtr. Right of way shall be constructed with R.C.C road with base course layer.
- ii. 15.00 mtr, 13.50 mtr and 9.00 mtr. With wet mix macadam, bitumen macadam and semi dense bituminous premix carpeting.

39.5. PREPARATION OF SUB-GRADE

Immediately prior to the laying of sub-base, the sub-grade shall be prepared by removing all vegetation and other extraneous matter, lightly sprinkled with water and rolled with smooth wheeled roller, as per PIU/ Relevant Specification/Relevant Codes/ Relevant Circular/CPWD.

39.6. WET MIXMACADAM SUB-BASE/BASE

i. SCOPE

- a) This work shall consist of laying and compacting clean, crushed, graded aggregate and granular material, premixed with water, to a dense mass on a prepared sub-grade/sub-base/base or existing pavement as the case may be in accordance with the requirements of these specifications. The material shall be laid in one or more layers as necessary to lines, grades and cross-sections shown on the approved drawings or as directed by the Engineer-In-charge.
- b) The thickness of a single compacted wet Mix Macadam layer shall not be less than 75mm. When vibrating or other approved types of compacting equipment are used, the compacted depth of a single layer of the sub-

base course may be upto 200 mm with the approval of the Engineer-In-charge.

ii. MATERIALS

a) Aggregates

Physical Requirements.

- Coarse aggregates shall be crushed stone. If crushed gravel/shingle is used, not less than 90 percent by weight of the gravel/shingle pieces retained on 4.75 mm sieve shall have at least two fractured faces. The aggregates shall conform to the physical requirements set form in table – A
- If the water absorption value of the coarse aggregate is greater than 2 percent, the soundness test shall be carried out on the material delivered to site as per IS 2386 (Part-5)

Table – A: Physical Requirements of coarse Aggregates for Wet Mix Macadam for Sub-base/Base Courses (MORTH Specifications)

S. No.	Test	Test Method	Requirements
1)	Los Angeless Abrasion value Or Aggregate Impact value	IS:2386 (Part-4) IS: 2386 (Part -4) or IS : 5640	40 Percent (Max.) 30 Percent (Max.)
2)	Combined Flakiness and Elongation indices (Total)	IS: 2386 (Part -1)	35 Percent (Max.)

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

Grading Requirements

The aggregates shall confirm to the grading given in Table –B

Table – B : Grading Requirements of Aggregates for Wet Mix Macadam (MORTH Specifications)

IS Sieve Designation	Percent by Weight passing the IS Sieve
53.00 mm	100
45.00 mm	95-100
26.50 mm	-
22.40 mm	60-80
11.20 mm	40-60
4.75 mm	25-40
2.36 mm	15-30
600 .00 micron	8-22
75 .00 micron	0-5

Material finer than 425 micron shall have plasticity index (PI) not exceeding 6. The final gradation approved within these limits shall be graded from coarse to fine

and shall not vary from the low limit on the sieve to the high limit on the adjacent sieve or vice versa.

iii. Construction operations

a) Preparation of Base

- Preparation of base/sub grade shall be as per PIU/ Relevant Specification/Relevant Codes/ Relevant Circular/CPWD

b) Provision of Lateral Confinement of Aggregates

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

c) Preparation of Mix

- Wet Mix macadam shall be prepared in an approved mixing plant of suitable capacity having provision for controlled addition of water and forced/Positive mixing arrangement like pugmill or pan type mixer of concrete batching plant. The plant shall have following features:
 - For feeding aggregates – three/four bin feeders with variable speed motor
 - Vibrating screen for removal of oversize aggregates
 - Conveyor Belt
 - Controlled system for addition of water
 - Forced/positive mixing arrangement like pug-mill or pan type mixer
 - Centralized control panel for sequential operation of various devices and precise process control
 - Safety devices.
- Optimum moisture for mixing shall be determined in accordance with IS: 2720 (Part-8) after replacing the aggregate fraction retained on 22.4 mm sieve with material of 4.75 mm to 22.4 size. While adding water, due allowance should be made for evaporation losses. However, at the time of compaction, water in the wet mix should not vary from the optimum value by more than agreed limits. The mixed material should be uniformly wet and no segregation should be permitted.

d) Spreading of Mix

- Immediately after mixing, the aggregates shall be spread uniformly and evenly upon the prepared sub-grades/sub-base in required quantities. In no case shall these be dumped in heaps directly on the area where these are to be laid nor shall their hauling over a partly completed stretch be permitted.
- The mix may be spread by a paver finisher. The paver finisher shall be self-propelled of adequate capacity with following features:
 - Loading hoppers and suitable distribution system, so as to provide a smooth uninterrupted material flow for different layer thicknesses from the tipper to the screed.
 - Hydraulically operated telescopic screed for paving width upto to 8.5 m and fixed screed beyond this. The screed shall have tamping and vibrating arrangement for initial compaction of the layer.
 - Automatic levelling control system with electronic sensing device to maintain mat thickness and cross slope of mat

during laying procedure.

- In exceptional cases where it is not possible for the paver to be utilized, mechanical means like motor grader may be used with the prior approval of the Engineer-in-charge. The motor grader shall be capable of spreading the material uniformly all over the surface.
- The surface of the aggregate shall be carefully checked with templates and all high or low spots remedied by removing or adding aggregate as may be required. The layer may be tested by depth blocks during construction. No segregation of larger and fine particles should be allowed. The aggregates as spread should be of uniform gradation with no pockets of fine materials.
- The Engineer may permit manual mixing and/or laying of wet mix macadam where small quantity of wet mix macadam is to be executed. Manual mixing/laying in inaccessible/remote locations and in situations where use of machinery is not feasible can also be permitted. Where manual mixing/laying is intended to be used, the same shall be done with the approval of the Engineer-In-charge.

e) Compaction

- After the mix has been laid to the required thickness, grade and crossfall/camber the same shall be uniformly compacted to the full depth with suitable roller. If the thickness of single compacted layer does not exceed 100mm, a smooth wheel roller of 80 to 100 KN weight may be used. For a compacted single layer upto 200mm, the compaction shall be done with the help of vibratory roller of minimum static weight of 80 to 100 KN with arrangement for adjusting the frequency and amplitude. An appropriate frequency and amplitude may be selected. The speed of the roller shall not exceed 5 km/h.
- In portions having unidirectional cross fall/Super elevation, rolling shall commence from the lower edge and progress gradually towards the upper edge. Thereafter, roller should progress parallel to the center line of the road, uniformly over-lapping each preceding track by at least one-third width until the entire surface has been rolled. Alternate trips of the roller shall be terminated in stops at least 1m away from any preceding stop.
- In portions in camber, rolling should begin at the edge with the roller running forward and backward until the edges have been firmly compacted. The roller shall then progress gradually towards the centre parallel to the centre line of the road uniformly overlapping each of the preceding track by at least one-third width until the entire surface has been rolled.
- Any displacement occurring as a result of reversing of the direction of a roller or from any other cause shall be corrected at once as specified and/or removed and made good.
- Along forms kerbs, walls or other places not accessible to the roller, the mixture shall be thoroughly compacted with mechanical tampers or a plate compactor. Sp patching of an area without scarifying the surface to permit proper bonding of the added material shall not be permitted.
- Rolling should not be done when the sub-grade is soft or yielding or when it causes a wave like motion in the sub-base/base course or sub-grade. If irregularities develop during rolling which exceeds 12 mm when tested with a 3m straight edge, the surface should be

loosened and premixed material added or removed as required before rolling again so as to achieve a uniform surface conforming to the desired grade and cross fall. In no case shall the use of unmixed material be permitted to make up the depressions.

- Rolling shall be continued till the density achieved is at least 98 percent of the maximum dry density for the material as determined by the method outlined in IS: 2720 (Part -8).
- After completion, the surface of any finished layer shall be well-closed, free from movement under compaction equipment or any compaction planes, ridges, cracks and loose material. All loose, segregated or otherwise defective areas shall be made good to the full thickness of the layer and recompacted.

f) Setting and drying

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

g) Opening to Traffic

- No vehicular traffic shall be allowed on the finished wet mix macadam surface. Construction equipment may be allowed with the approval of the Engineer-In-charge.

Surface Finish and Quality control of work

h) Surface Evenness

- The surface finish of construction shall conform to the requirements of MORTH/PIU/ Relevant Specification/Relevant Codes/ Relevant Circular/CPWD

i) Quality Control

- Control on the quality of materials and works shall be exercised by the Engineer-in-charge in accordance with MORTH/PIU/ Relevant Specification/Relevant Codes/ Relevant Circular/CPWD

j) Rectification of Surface irregularity

- Where the surface irregularity of the wet mix macadam course exceeds the permissible tolerances or where the course is otherwise defective due to sub-grade soil getting mixed with the aggregates, the full thickness of the layer shall be scarified over the affected area, re-shaped with added premixed material or removed and replaced with fresh premixed material as applicable and re-compacted in accordance with MORTH/PIU/ Relevant Specification/Relevant Codes/ Relevant Circular/CPWDs. The area treated in the aforesaid manner shall not be less than 5m long and 2m wide. In no case shall depressions be filled up with unmixed and ungraded material or fines.

k) Arrangement for Traffic

- During the period of construction, arrangements for traffic shall be done to enable smooth execution of all construction and related activities.

39.7. DRY LEAN CEMENT CONCRET SUB-BASE

i. SCOPE

The work shall consist of construction of (Zero Slump) dry lean concrete sub-base for cement concrete pavement in accordance with the requirements of these specifications and in conformity with the lines, grades and cross sections shown on the drawings or as directed by the Engineer. The work shall include furnishing of all plant and equipment, materials and labour and performing all operations, in connection with the work, as approved by the Engineer-in-charge.

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

ii. Materials

a) Source of materials

The contractor shall indicate to the Engineer-In-charge the source of all materials with relevant test data to be used in the dry lean concrete work sufficiently in advance and the approval of the Engineer-in-charge for the same shall be obtained at least 45 days before the schedule commencement of the work in trial length. If the Contractor later proposes to obtain the materials from a different source during the execution of main work, he shall notify the Engineer-In-charge with relevant test data for his approval at least 45 days before such materials are to be used.

b) Cement

Portland Pozzolana Cement (PPC)	IS:1489-Part I
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If the subgrade soil contains soluble sulphates in a concentration more than 0.5 percent, sulphate resistant cement conforming to IS : 6909 shall be used.

Cement to be used may preferably be obtained in bulk form. It shall be stored in accordance with stipulations contained in as per PIU/ Relevant Specification/Relevant Codes/ Relevant Circular/CPWDs and shall be subjected to acceptance test prior to its immediate use.

c) Fly-ash

Fly-ash upto 20 percent by weight of cementitious material (cement-fly-ash) may be used along with 43/S3 grade cement may be used to replace OPC cement grade 43 upto 30 percent by weight of cement. Fly-ash shall conform to IS:3812(Part 1) and its use shall be permitted only after ensuring all facilities exist for uniform blending through a proper mechanical facility with automated process control like batch mix plant conforming to IS:4925 and IS:4926 or PPC as per IS:1489(Part-I)

d) Aggregates

Aggregates for lean concrete shall be natural material complying with IS: 383, the aggregates shall not be alkali reactive. The limits of deleterious material shall not exceed the requirement as in PIU/ Relevant Specification/Relevant Codes/ Relevant Circular/CPWD. In case the Engineer In charge considers that the aggregates are not free from dirt, the same may be washed and drained for at least 72 hours before batching or as directed by the Engineer-in-charge.

i. Coarse Aggregates

Coarse aggregates shall comply with PIU/ Relevant Specification/Relevant Codes/ Relevant Circular/CPWDs except that the maximum size of the coarse aggregate shall be 26.5mm and aggregate gradation shall comply with Table D

ii. Fine Aggregates

The fine aggregates shall comply with PIU/ Relevant Specification/Relevant Codes/

Table D: Aggregate Gradation for Dry Lean Concrete

Sieve Designation	Percentage by Weight Passing the Sieve
26.50 mm	100
19.0 mm	75-95
9.50 mm	50-70
4.75 mm	30-55
2.36 mm	17-42
600 micron	8-22
300 micron	7-17
150 micron	2-12
75 micron	0-10

iii. Water

Water used for mixing and curing of concrete shall comply with MORTH PIU/ Relevant Specification/Relevant Codes/ Relevant Circular/CPWD.

iv. Storage of Materials

All materials shall be stored in accordance with the provisions of PIU/ Relevant Specification/Relevant Codes/ Relevant Circular/CPWDs and other relevant IS specifications.

v. Proportioning of Materials for the Mix

The mix shall be proportioned with a maximum aggregates cementitious material ratio of 15:1. The water content shall be adjusted to the optimum as per CPWD/IS specifications for facilitating compaction by rolling. The strength and density requirements of concrete shall be determined in accordance with CPWD/ MORTH specification by making trial mixes. Care should be taken to prevent one size of aggregate falling into the other size of the hopper of the feeding bin while loading the individual size of aggregates into the bins.

vi. Moisture Content

The optimum water content shall be determined and demonstrated by rolling during trial length construction and the optimum moisture content and degree of compaction shall be got approved from Engineer In charge. While laying in the main work, the lean concrete shall have a moisture content between the optimum and optimum +2 percent, keeping in view the effectiveness of compaction achieved and to compensate for evaporation losses.

vii. Cement Content

The Cement Content in the dry lean concrete shall be such that the strength specified in relevant part of concrete strength is achieved. The minimum cement content shall be 150kg/cum of concrete. In case fly-ash is blended at site as part replacement of cement the quantity of fly ash shall not be more than 20 percent by weight of cementitious material and the content of OPC shall not be less than 120kg/cum or PPC as per IS-1489(Part-I)

If this minimum is not sufficient to produce dry lean concrete of the specified strength it shall be increased as necessary by the contractor at his own cost.

viii. Concrete Strength

The Above compressive strength of each consecutive group of 5 cubes made in accordance with CPWD/IS specifications shall not be less than 10 MPa at 7 days. In addition ,the

minimum compressive strength of any individual cube shall not be less than 7.5 MPa at 7 days. The design mix complying with the above Clauses shall not be approved from the Engineer In charge and demonstrated in the trial length construction.

ix. Sub-grade

The sub-grade shall conform to the grades and cross sections shown on the drawings and shall be laid and compacted in accordance with PIU/ Relevant Specification/Relevant Codes/ Relevant Circular/CPWD. The subgrade strength shall correspond to the design specified in the Contract. As far as possible, the construction traffic shall be avoided on the prepared sub-grade

x. Drainage Layer

A Drainage layer conforming to PIU/ Relevant Specification/Relevant Codes/ Relevant Circular/CPWD shall be laid above the subgrade before laying the Dry Lean Concrete sub-base, as specified on PIU/ Relevant Specification/Relevant Codes/ Relevant Circular/CPWD.

xi. Construction

• General

The Dry Lean concrete shall be laid on the prepared granular drainage layer. The pace and programme of the Dry Lean Concrete sub-base construction shall be matching suitably with the programme of construction of the cement concrete pavement over it. The Dry Lean Concrete sub-base shall be overlaid with concrete pavement only after 7 days of sub-base construction.

• Batching and Mixing

The Batching plant shall be capable of proportioning the materials by weight each type of material being weighed separately in accordance with MORTH/PIU/ Relevant Specification/Relevant Codes/ Relevant Circular/CPWDs.

The design features of Batching Plant should be such that the plant can be shifted quickly.

• Transporting

Plant mix lean concrete shall be discharged immediately from the mixer, transported directly to the point where it is to be laid and protected from the weather covering the tipping trucks with tarpaulin during transit. The concrete shall be transported by tipping trucks, sufficient in number to ensure a continuous supply of material to feed the laying equipment to work at a uniform speed and in an uninterrupted manner. The lead of the batching plant to paving site shall be such that the travel time available from mixing to paving as specified in PIU/ Relevant Specification/Relevant Codes/ Relevant Circular/CPWD will be adhered to. Tipping trucks shall not have old concrete sticking to it Each tipping truck shall be washed with water jet before next loading as and when required after inspection.

• Placing

Lean concrete shall be placed by a paver with electronic sensor on the drainage layer or as specified in the Contract. The equipment shall be capable of laying the material in one layer in an even manner without segregation, so that after compaction the total thickness is as specified. The paving machine shall have high amplitude tamping bears to give good initial compaction to the sub base. One day before placing of the dry lean cement concrete sub-base, the surface of the granular sub-base/drainage layer shall be given a fine spray of water and rolled with a smooth wheeled roller.

Preferably the lean concrete shall be placed and compacted across the full width of

the two lane carriageway, by constructing it in one go. In roads with carriageway more than 2 lanes a longitudinal joint shall be provided. Transverse butt type joint shall be provided at the end of the construction in a day. Transverse joints in the concrete pavement shall not be coterminous with the transverse construction joint of the Dry Lean Concrete.

The Dry Lean Concrete shall be laid in such a way that it is at least 750 mm wider on each side than the proposed width including paved shoulders of the concrete pavement. The actual widening shall be decided based on specifications of the paver, such that the crawler moves on the dry Lean Concrete, and the cost extra width shall be borne by the Contractor.

- **Compaction**

The Compaction shall be carried out immediately after the material is laid and levelled. In order to ensure thorough compaction, rolling shall be continued on the full width till there is no further visible movement under the roller and the surface is well closed. The minimum dry density obtained shall not be less than 98 percent of that achieved during the trial length construction in accordance with CPWD /IS Specifications. The densities achieved at the edges i.e. 0.5 m from the edge shall not be less than 96 percent of that achieved during the trial construction.

The Spreading, compacting and finishing of the lean concrete shall be carried out as rapidly as possible and the operation shall be so arranged as to ensure that the time between the mixing of the first batch of concrete in any transverse section of the layer and the final finishing of the same shall not exceed 90 minutes when the temperature of concrete is between 25° c and 30°c and 120 minutes if less than 25°c. This period may be reviewed by the Engineer in the light of the results of the trial run but in no case shall it exceed 120 minutes. Work shall not proceed when the temperature of the concrete exceeds 30°c. If necessary chilled water or addition of ice may be resorted to for bringing down the temperature. It is desirable to stop concreting when the ambient temperature is above 35°c. After compaction has been completed, roller shall not stand on the compacted surface for the duration of the curing period except during commencement of next day's work near the location where work was terminated the previous day.

Double drum smooth-wheeled vibratory rollers of minimum 80 to 100 KN static weight are suitable for rolling dry lean concrete. In case any other roller is proposed the same shall be got approved from the Engineer-In-charge, after demonstrating its performance. The number of passes required to obtain maximum compaction depends on the thickness of the dry lean concrete, the compactibility of the mix and the weight and type of the roller and the same as well as the total requirement of rollers for the jobs shall be determined during trial run by measuring in-situ density and the scale of the work to be undertaken.

Except on Super elevated portions where rolling shall proceed from the inner edge to the outer, rolling shall begin from the edges gradually progressing towards the centre. First, the edge/edges shall be compacted with a roller running forward and backward. The roller shall then move inward parallel to the centerline of the road, in successive passes uniformly lapping preceding tracks by at least one half width.

A preliminary Pass without vibration to bed the Dry lean concrete down shall be given followed by the required number of passes to achieve the desired density and, a final pass without vibration to remove roller with vibration

marks and to smoothen the surface.

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

The final lean concrete surface on completion of compaction shall be well closed, free from movement under roller and free from ridges, low spots, cracks, loose material, pot holes, ruts or other defects. The final surface shall be inspected immediately on completion and all loose, segregated or defective areas shall be corrected by using fresh lean concrete material, laid and compacted. For repairing honeycombed/hungry surface, concrete with aggregates of size 10 mm and below shall be spread and compacted as per specifications. It is necessary to check the level of the rolled surface for compliance. Any level/thickness deficiency shall be corrected after applying concrete with aggregates of size 10mm and below after roughening the surface. Surface regularity also shall be checked with 3m straight edge. Strength tests shall be carried out, and if deficiency in strength is noticed, at least three (evenly spread) cores of minimum 100 mm dia per km shall be cut to check deficiency in strength. The holes resulting from cores shall be restored by filling with concrete of the specified strength and compacted by adequate rodding.

Segregation of concrete in the tipping trucks shall be controlled by moving the dumper back and forth while discharging the mix into the same or by any appropriate means. Paving operation shall be such that the mix does not segregate.

- **Joints**

Construction and longitudinal joints shall be provided as per the drawings.

- **Concrete Pavement**

Transverse butt type joint shall be provided at the end of the construction in a day.

Longitudinal construction joint shall be provided only when full width paving is not possible. Transverse joints in Dry Lean concrete shall be staggered from the construction butt type joint in concrete pavement by 800-100mm

Longitudinal joint in Dry Lean Concrete shall be staggered by 300-400 mm from the longitudinal joint of concrete pavement

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

- **Curing**

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

- a) Curing may be done by covering surface by gunny bags/hessian, which shall be kept wet continuously for 7 days by sprinkling water.
- b) The curing shall be done by spraying with approved resin based aluminized reflective curing compound conforming to ASTM-C 309-81 in accordance with PIU/ Relevant Specification/Relevant Codes/ Relevant Circular/CPWDs. As soon as the curing compound has lost its tackiness, the surface shall be covered with the wet hessian for three days. The rate of application shall be as recommended by the supplier.
- c) Wax based white pigment curing compound with water retention index of not less than 90 percent shall be used to cure the dry the Lean

concrete. The curing compound shall conform to BS:7542. The compound shall be applied uniformly with a mechanical sprayer and with a hood to protect the spray from the wind. The curing compound shall be applied over the entire exposed surface of the Dry Lean Concrete, including sides and edges, at the rate of 0.2 litres/sq.m or as recommended by the supplier.

The first application, referred to as curing application shall be applied immediately after the final rolling of Dry Lean Concrete is completed. As soon as the curing compound loses tackiness, the surface shall be covered with wet hessian for three days. The second application of curing compound also referred to as the debonding application shall be applied 24 to 48 hours prior to the placement of the concrete pavement. Any damaged Dry Lean concrete shall be corrected prior to the second application. Normally, the manufacturer's instructions shall be followed for its application.

Surface Finish and Quality Control of Works

The surface finish of construction shall conform to the requirements. Control on the quality of materials and works shall be exercised by the Engineer in charge in accordance with PIU/ Relevant Specification/Relevant Codes/ Relevant Circular/CPWD.

Cement Concrete Kerb and Kerb with Channel Scope

This work shall consist of constructing cement concrete kerbs and kerbs with channel in the central medians and or along the footpaths or separators in conformity with the lines levels and dimensions as specified in the drawings or as directed by Engineer in charge.

Materials

Kerbs and kerb with channel shall be provided in cement concrete of Grade M30 in accordance with the PIU/ Relevant Specification/Relevant Codes/ Relevant Circular/CPWD.

39.8. FOOTPATHS AND SEPARATORS

i. Scope

1) The work shall consist of constructing footpaths and/or separators at locations as specified in the drawings or as directed by the Engineer in charge.

The lines, levels and dimensions shall be as per the drawings. The scope of the work shall include provision of all drainage arrangements as shown in the drawings or as directed by the Engineer in charge.

i. Materials

The footpaths and separators shall be constructed with the following types:

- a. Cast-in-situ cement concrete of Grade M 30 as per PIU/ Relevant Specification/Relevant Codes/ Relevant Circular/CPWDs. The minimum size of the panels shall be as specified in the drawings
- b. Precast cement concrete blocks and interlocking blocks/tiles of grade not less than M 30 as per PIU/ Relevant Specification/Relevant Codes/ Relevant Circular/CPWDs. The thickness and size of the cement concrete blocks or interlocking blocks/ tiles shall be as specified in the drawings.

39.9. FOR PREMIX SURFACING

- i. The work shall consist of the preparation, laying and compaction of premix surfacing material of 20/25 mm thickness composed of small sized aggregates premixed with a bituminous binder according to Job mix formula in accordance with the requirements of these Specifications / as per PIU/ Relevant Specification/Relevant Codes/ Relevant Circular/CPWDs.

ii. Materials

- a) **Binder:** The binder shall be viscosity grade bitumen of grade VG 10 or as specified in the contract and shall satisfy the requirement of IS-73.

- b) **Coarse aggregates:** The coarse aggregates shall consist of crushed rock, crushed gravel or other hard material retained on the 2.36 mm sieve. They shall be clean, hard, durable, of cubical shape, free from dust and soft or friable matter, organic or other deleterious matter. Where the Contractor's selected sources of aggregate have poor affinity for bitumen, as a condition for the approval of that source, the bitumen shall be treated with approved anti-stripping agents as per the manufacturers recommendations without additional payment. Before approval of the source, the aggregates shall be tested for stripping.

The aggregates shall satisfy the physical requirements set forth as follows: -

Property	Test	Specification
Particle shape	Flakiness Index ¹	Max. 25 percent
Strength	Aggregate Impact Value ²	Max. 30percent
Water absorption	Water absorption ⁴	Max. 2 percent
Stripping	Coating and stripping of bitumen aggregate mixtures ⁵	Min. retained coating 75 percent

Note: 1. IS:2386 Part 1 2. IS:2386 Part 4
3. IS:2386 Part 5 4. IS:2386 Part 3
5. IS:6241

Where crushed gravel is proposed for use as aggregate, not less than 90 per cent by weight of the crushed material retained on the 4.75 mm sieve shall have at least two fractured faces.

- c) **Fine aggregates:** The fine aggregates shall consist of crushed rock, quarry sands, natural gravel/sand or a mixture of both. These shall be clean, hard, durable, un-coated mineral particles, dry and free from injurious, soft or flaky particles and organic or deleterious substances. All specifications shall be as per PIU/ Relevant Specification/Relevant Codes/ Relevant Circular/CPWD.

39.10. BITUMINOUS PENETRATION MACADAM

i. SCOPE

The work shall consist of one layer of compacted crushed coarse aggregates with alternate applications or bituminous binder and key aggregate in accordance with the requirements of the specifications to be used as a base course on roads, subject to the requirements of the overall pavement design, in conformity with the lines/grades and cross-section.

ii. MATERIAL BITUMEN

The binder shall be paving bitumen of specified penetration grades conforming to IS 73 or approved cutback satisfying the requirement of IS 217 or 454 as specified in item.

iii. AGGREGATES

The coarse aggregates shall consist of crushed rock, crushed gravel or other hard material retained on the 2.36mm IS sieve. The aggregate should conforming to PIU/ Relevant Specification/Relevant Codes/ Relevant Circular/CPWDs.

iv. QUANTITY OF MATERIALS

The quantity of materials used for this work, shall be as per PIU/ Relevant Specification/Relevant Codes/ Relevant Circular/CPWDs (composition of penetration macadam).

v. CONSTRUCTION OPERATIONS

- a) All the construction operations shall be as per PIU/ Relevant Specification/Relevant Codes/ Relevant Circular/CPWDs/ as per relevant IS code.
- b) The thickness of bituminous macadam shall be 50 mm -75 mm.

39.11. RCC ROADS & CC PAVEMENTS

- a) On the sub base layer (Dry lean cement concrete), top finished layer (base layer) with reinforced cement concrete M-30, 200 mm thick is to be constructed including dewatering process as per PIU/ Relevant Specification/Relevant Codes/ Relevant Circular/CPWD / IRC code. The reinforcement shall be provided as per structural drawing / decision of Engineer in Charge.
- b) Service roads 6m wide and 9m at turning points from the main RCC roads to all round the builds are to be constructed, as per firefighting norms. The specifications for these roads (b) shall be as subgrade with powder roller, two base course 100mm & 75mm thick with WMM, 150 RCC M-30 concrete with nominal reinforcement (approx.. 20Kg/sqm) with De-watering process with expansion / construction joint including filler joint shall be constructed as per PIU/ Relevant Specification/Relevant Codes/ Relevant Circular/CPWD.
- c) From service roads, 3m wide footpath with 80mm thick interlocking pavers (20% colored pavers) on 100mm base lean concrete 1:4:8 (M.10) upto building entrance to be constructed as per PIU/ Relevant Specification/Relevant Codes/ Relevant Circular/CPWD.
- d) All ramps for handicapped / disabled persons are to be provided as per norms for all buildings.
- e) Painting and marking of the roads, parking, cycles track, footpaths and handicapped ramps are to be completed as standard road signs & specifications.
- f) **Parking :**
 - Provision for parking spaces has been made on the basis of "Equivalent car space" (ECS) as laid down under "Building Bye Laws" of Palitana Authority.
 - Parking space has been planned with adequate vehicular access to a street and the area of drives, aisles and such other provisions required for adequate maneuvering of vehicles shall be exclusive of the parking space.

40. STORMWATER DRAINAGE

i. Planning of Storm Water Drainage System

- a) The rainwater from open surface sandy terrace area are to be collected and stored at proposed pond at lower gradient of Master plan level. The surplus rain water shall be disposed to nearby river/sea.
- b) The storm water system shall be mostly catch basins and RCC NP2 pipe IS-16098 (Part-2) network and shall be directly connected to main storm water drains.

- c) Since the sub soil water table is about 1.50 mtr to 2.50 mtr from general ground level, the rain water harvesting system is not possible and the storm water from main storm drain of the Campus shall be discharged in to the existing ponds in the campus and surplus water to river / sea.

ii. Design Parameters

- a) Min. Pipe diameters for main storm water drain shall be 250 mm dia in line with local authority requirements.
- b) All construction specifications with respect to the manhole sizes etc. shall be followed as per PIU/ Relevant Specification/Relevant Codes/ Relevant Circular/CPWD.
- c) The complete campus storm water drainage system for Palitana District Hospital Campus designed with RCC pipes, clay brick masonry chambers and manholes etc.

iii. Irrigation system for lawns and gardens

- a) Gardens and lawns shall be irrigated in combination of Garden Hydrant System and Sprinkler Irrigation System. Garden Hydrant System, Network System
- b) It is proposed to provide a separate and independent captive garden hydrant system to supply water for horticultural operations to all landscaped areas.
- c) The distribution grid for garden mains will be by a separate grid of HDPE IS-14151 pressure pipes and connected to a separate pumping set obtaining it's water supply from
- d) STP & raw water tank.
- e) The Main Distribution grid shall be with HDPE IS-14151 pipes and balance distribution system will be with CPVC heavy duty pressure pipes conforming to specifications.
- f) Garden hydrant points shall be of 25 mm outlets and located approximately 45-50 mtr apart.
- g) The garden hydrant pumping system is proposed to be planned so that the system and maximum one grid six outlet at same time.

iv. Sprinkler Irrigation System, Network System

- a) Sprinkler Irrigation is a method of applying irrigation water which is similar to rainfall. Water is distributed through a system of pipes usually by pumping. It is then sprayed into the air and irrigated entire soil surface through spray heads so that it breaks up in to small water drops which fallt othe ground.
- b) Sprinklers provide efficient coverage for small to large areas and are suitable for use on all types' of properties.
- c) It shall be designed to ensure maximum water saving, combining high quality, affordability and ease of installation. All the products are made out of high strength & chemical resistance engineering plastics to achieve functional satisfaction and to maintain cost economics.
- d) All sprinklers undergo extensive quality testing in our well-equipped state of the art lab. Performances of the products shall also be tested, as per relevant specifications, in the field to ensure uniform water distribution and higher efficiency.

41. TECHNICAL SPECIFICATIONS - HORTICULTURE WORKS:

41.1. Scope of work

The work shall in general conform to the Latest PIU/ Relevant Specification/Relevant Codes/ Relevant Circular/CPWDs for works. Work under this Contract shall consist of furnishing all labour, materials, equipment and appliances necessary and required.

The Contractor is required to completely furnish all the plumbing and other specialized services as described hereinafter and as specified in the schedule of quantities for Horticulture works.

41.2. Excavation

The top excavated soil shall be collected, stacked, preserved for use in landscaping / horticulture works. Surplus top excavated soil may be given to the nurseries or put to use in other Horticulture works.

41.3. GRASSING

i) Preparation

- a) During period prior to planting the ground shall be maintained free from weeds.
- b) Grading and final leveling of the lawn shall be completed at least three weeks prior to the actual sowing. Clods of excavated earth shall then be broken upto the size not more than 75mm in any direction. The area shall then be flooded with water and after 10 days and within 15 days of flooding, weeds that re-germinate shall be uprooted carefully. The rubbish arising from this operation shall be removed and disposed of in a manner directed by Engineer. Regular watering shall be continued until sowing by dividing the lawn area into portion or approx 5 mts. Square by constructing small bunds to retain water. These 'bunds' shall be level just prior to sowing of grass plants. At the time of actual planting of grass, it shall be ensured that the soil has completely settled.
- c) Slight unevenness, ups and downs and shallow depressions resulting from the settlement of the flooded ground, in drying and from the subsequent weeding operations, shall be removed by fine dressing the surface to the final levels by adding suitable quantities of good earth brought from outside, if necessary as directed by the Engineer. In fine dressing, the soil at the surface and for 40mm depth below shall be broken down to particles of size not exceeding 6mm in any direction.

ii) SOIL:

The soil itself shall be ensured to satisfaction of Engineer to be a good, fibrous loam, rich in humus.

iii) SOWING THE GRASS ROOTS :

- a) Grass roots (Cynodon dactylon or a local approved by the Engineer) shall be obtained from a grass patch, seen and approved beforehand.
- b) The grass roots stock received at site shall be manually cleaned of all weeds and water sprayed over the same after keeping the stock in a place protected from sun and dry winds.
- c) Grass stock received at site may be stored for a maximum of three days. In case grassing for some areas is scheduled for a later date fresh stock of grass roots shall be ordered and obtained.

iv) EXECUTION :

- a) Small roots shall be debbled about 15 cms (or at other spacings as per BOQ item) apart into the prepared grounds. Dead grass and weeds shall not be planted.
- b) Grass areas will only be accepted as reaching practical completion when germination has proved satisfactory and all weeds have been removed.
- c) All planting is to be done in moderately dry to moist (not wet) soil and at times when wind does not exceed a velocity of 8 kilometer per hours.

v) MAINTENANCE OF LAWN

- a) As soon as the grass is approximately an inch high it shall be rolled with a light wooder, roller in fine, dry weather and when it has grown to 2 to 3 inches above the ground, weeds must be removed and regular cutting with

the scythe and rolling must be begun. A top dressing of annouce of guano to the square yard on well decomposed well broken sludge manure will help on the young grass. The scythe must continue to be used for several months until the grass is sufficiently secure in the ground to bear the mowing machine. It should be possible to use the inch above the normal level of the first two or three cuttings. That is to day the grass should be cut so that it is from 1 to 2 inches in length, instead of the $\frac{1}{2}$ to $\frac{3}{4}$ of an inch necessary for mature grass.

- b) In absence of rain the lawn shall be watered every ten days heavily, soaking the soil through to a depth of at least 25 cms.
- c) Damage failure or dying back of grass due to neglect of watering especially for seeding out of normal season shall be the responsibility of the contractor.
- d) Any shrinkage below the specified levels during the contract or defects liability period shall be rectified at the contractor's expense.
- e) The contractor is to exercise care in the use of rotary cultivator and mowing machines to reduce to a minimum the hazards of flying stones and brickbats. All rotary mowing machines are to be fitted with safety guards.

vi) **ROLING:**A light roller shall be used periodically, taking care that the lawn is not too wet and sodden. Rolling should not be resorted to, to correct the levels in case certain depressions are formed due to watering

v. **EDGING:** The contractor shall establish a neat edge where planting areas meet grass areas with spade or edging tool immediately after all planting, including lawn planting, is completed. Particular care shall be exercised in edging to establish good flowing curves as shown on the plans or as directed by the Engineer. Edging must be cut regularly and shall be maintained by the contractor.

vi. **FERTILIZING:**The lawn shall be fed once a month with liquid manure prepared by dissolving 45 grams of ammonia sulphate in 5 litres of water.

vii. **WATERING:** Water shall be applied daily during dry weather. Watering whenever done should be thorough and should wet the soil at least upto a depth of 20 cms to eliminate air pockets and settle the soil.

viii. **WEEDING:**Prior to regular mowing the contractor shall carefully remove rank and unsightly weeds.

ix. **MAINTENANCE:**

The landscape contractor shall maintain all planted area within the landscape contract boundaries until the period of one year after the complete plantation. Maintenance shall include replacement of dead plants. Watering, weeding, cultivating, control of insects, fungicide and other disease by means of spraying with an approved insecticide or fungicide, pruning and other horticulture operations necessary for the proper growth of the plants and for keeping the landscape sub-contract area neat in **appearance**.

x. **PRUNING & REPAIRS:**

Upon completion of planting work on the landscape sub-contract all trees should be pruned and all injuries repaired where necessary. The amount of pruning shall be limited to the minimum necessary to remove dead or injured twigs and branches and to compensate for the loss of roots and the results of transplanting operations. Pruning shall be done in such a manner as not to change the natural habit or special shape of the trees. In general, one third to one fourth branching structure of the plants to be removed to compensate the loss of roots during transplantation by thinning or shortening branches but no leaders shall be cut. All pruning shall be done with sharp tools in accordance with instructions of the HITES. Pruning cuts shall be painted with recommended paints.

41.4. DIGGING HOLES FOR PLANTING TREES

In ordinary soil, refilling earth after mixing with manure and watering.

Holes of circular shape in ordinary soil shall be excavated and excavated soil broken to clods of size not exceeding 75mm in any direction, shall be stacked outside the hole, stones, brick bats, unsuitable earth and other rubbish, all roots and other undesirable growth met with during excavation shall be separated out and unserviceable material removed from the site as directed. Useful material, if any, shall be stacked properly and separately. Good earth in quantities as required shall to replace such discarded stuff shall be brought and stacked at site by the contractor. The tree holes shall be manured with powdered Neem/Castor oil cake at the specified rate along with farm yard manure over sludge shall be uniformly mixed with the excavated soil after the manure has been broken down to powder, (size of particle not be exceeded 6mm in any direction) in the specified proportion, the mixture shall be filled in to the hole up to the level of adjoining ground and then profusely watered and enable the soil to subside the refilled soil shall then be dressed evenly with its surface about 50 to 75 mm below the adjoining ground level or as directed by the Engineer-in-charge.

41.5. M.S IRON RIVETED TREE GUARD

The tree guard shall be 600mm in diameter and 2 meter high above ground level and 25cm in below ground level. The tree guard shall be framed of 4 nos. 25 x 6mm M.S flat 2 meter long excluding displayed outward at lower and upto an extent 10cm and 8nos. 25x 3 mm vertical M.S Flat riveted to 3 nos. 25x6mm flat iron rings in two halves, bolted together 8mm dia and 30mm long M.S bolts and nuts. The entire tree guard shall be given two coats of synthetic enamel paint of approved brand and manufacturer. The design of tree guards shall be shown in the drawing.

41.6. FLOODING THE GROUND WITH WATER AND MAKING KIARIES

The water for flooding shall be of soft water and free from chemical and good for growing the trees and shrubs etc. Before flooding the kiaries shall be made in required size and shape as per directions of Officer-in-charge. After uprooting weeds from the trenched area and uprooting vegetation, kiaries shall be dismantled.

41.7. SPECIFICATIONS OF PLANTS

- i. The plants should be as per following specification.
 - a. The plants should be full of fresh and healthy foliage.
 - b. The plants should be free from insect, pest and disease.
 - c. Plant should be healthy and vigorous growth
 - d. The height of the plants will be measured from top of the pots.
 - e. The plants should be well settled and should not be newly shifted.
 - f. The plants should be true to the variety and named Variety should be tagged.
 - g. Moss stick used should be made on plastic pipe.
 - h. Moss stick should be straight and properly fixed in the pot.
 - i. The rejected plants materials should be removed from the site immediately.
 - j. Moss stick should be covered with the plants in case of plants supplied with moss stick.
 - k. The Plant should be well established and good spread.
 - l. Good earth and manure used for filling the pot/poly bag free from any inert material and mixed to proper ratio.
 - m. Pot/ Poly bag used for filling the plants should be proper size good quality not damaged.

- n. There should be proper drainage in pots for plants.
- o. The flowering plants should also have proper flowering and should be true to the variety.
- p. All plant should have the tendency of growth and should not be stunted type.
- q. There should be no stagnation of water in the pots.

41.8. TREEGUARDS:

Where tree guards are necessary, care should be taken to ensure that they do not impede movement or restrict growth.

41.9. NURSERY STOCK:

- i. Planting should be carried out as soon possible after reaching site. Where planting must, of necessity, be delayed, care should be taken to protect the plants from pilfering or damage from people or animals.
- ii. Plants with bare roots should be heeled in as soon as received or otherwise protected from dying out, and others set closely together and protected from the wind. If planting should be unpacked, the bundles opened up and each group of plants heeled in separately and clearly abeled. If for any reason the surface of the roots becomes dry the roots should be thoroughly soaked before planting.

41.10. PROTECTIVE FENCING

According to local environment shrubs may have to be protected adequately from vandalism until established.

12 COMPLETION:

On completion the ground should be formed over and left tidy.

FORM OF WATER PROOFING WORKS

GUARANTEE BOND ON STAMPED PAPER

This agreement made this.....day of two thousand..... between M/s.....(hereinafter called the Guarantor of the one part) and the President of India (hereinafter called the Govt. of the other part).

Whereas this agreement is supplementary to the contract (hereinafter called the Contract) dated..... made between the Guarantor of the one part and Govt. of the other part, whereby the contractor inter alia, undertook to render the Buildings and structures in the said contract recited completely water and leak proof.

And whereas the Guarantor agreed to give a guarantee to the effect that the said structure will remain waterproof for ten years to be reckoned from the date after the maintenance period prescribed in the contract expires.

During this period of guarantee the Guarantor shall make good all defects and for that matter, shall replace at his risk and cost such members as may be damaged by water and in case of any other defect being found he shall render the building waterproof at his cost to the satisfaction of the Engineer-in-Charge and shall commence the works of such rectification within seven days from the date of issuing notice from the Engineer-in-Charge calling upon him to rectify the defects failing which the work shall be got done by the Department by some other contractor at the Guarantor's cost and risk and in the latter case the decision of the Engineer-in-charge as to the cost,

recoverable from the Guarantor shall be final and binding.

That if the Guarantor fails to execute the waterproofing or commits breaches hereunder then the Guarantor will indemnify principal and his successors against all loss, damage, cost, expense or otherwise which may be incurred by him by reason of any default on the part of the Guarantor in performance and observance of this supplemental agreement. As to the amount of loss and/or damage and/or cost incurred by the Government the decision of the Engineer-in-charge will be final and binding on the parties.

In witness whereof of these presents have been executed by the Obligor.....and by..... For and on behalf of the President of India on the day, month and year first above written.

SIGNED, SEALED and delivered by OBLIGOR in presence of-

1.

2.

SIGNED for and on behalf of THE PRESIDENT OF INDIA by.....in the presence of-

1.

2.

GUARANTEE BONDS

GUARANTEE TO BE EXECUTED BY CONTRACTOR FOR CURTAIN WALL/STRUCTURAL GLAZING AND OTHER RELATED WORKS AFTER COMPLETION OF WORK

This agreement made this day of two thousand and

between

(Name of contractor, hereinafter call Guarantor of the one part) and the
PRESIDENT OF INDIA (hereinafter called the Government of the other part).

WHEREAS THIS agreement is supplementary to a contract (hereinafter called the Contract) dated.....made between the GUARANTOR of the one part and the GOVERNMENT of the other part for Construction of Hospital Block(G+5) including all internal & external services of Civil, Electrical, Mechanical including STP, WTP, Roads, Footpaths, Signages, Landscaping & Horticulture etc Fire, GRIHA & IGBC compliant buildings for a Functional Permanent Campus, IISER at Palitana, Odisha. Whereby the Contractor, inter-alia, undertook to carry out structural analysis and design, preparation of shop drawings, getting the structural design and shop drawings vetted from the Principals of the curtain wall system, setting out, fabrication, supply, assemble, install, align and fix to the building structure the curtain wall and execute other related works, all as specified and set out in the contract and as per the correct international/ national standards.

AND WHEREAS THE GUARANTOR agreed to give a guarantee (for all works as stated above) for the following:

1. System

- 1.1 Structural design has been carried out for design loads, as specified, thermal stresses, building movements and the consequent deflections without compromising the performance characteristics.
- 1.2 That deflections in the framing members shall be within permissible limits as specified.
- 1.3 Structural stability, safety, integrity and required performances of the work for all design loads and building movements as specified.

2. Material

- 2.1 Glass (Single, Laminated or IGUs) – Substrate, coatings, lamination of laminated glass, insulate on of IGUs. Replacement of broken glass panes (breakage not attributable to vandalism or accident), defective insulated glazed units (evident due to condensation or dirt between the lites, failure of seal and damage to internal glass panes, staining, damage to the soft coating etc.) during the guarantee period.
- 2.2 Sealants–Material used, performance of sealant used, usage as per the requirement of structural design and functional requirement, compatibility with different substrate and sealants, bite size, quality assurance during sealing of IGUs and fixing glass to glass and glass to the aluminium frame, etc.
- 2.3 EPDM/ Silicone gasket–for ozone resistance and other properties as specified etc.
- 2.4 Aluminum- material quality, tempering requirement, suitability of aluminium grade and anodizing etc.

- 2.5 Anchor fasteners – suitability and strength requirements as per manufacturers’s specifications etc..
- 2.6 Aluminum composite panel cladding- Material quality and PVDF coating / lumiflon-based fluoropolymerresin coating for colour retention, chalking resistance, humidity resistance, hardness and gloss retention etc as specified.
3. Performance
 - 3.1 Water tightness, wherever specified in the Contract.
 - 3.2 workmanship
 - 3.3 Integrity of system during movements within and relative to the building structure.
 - 3.4 Indemnify the Department against all claims of whatsoever nature due to defective designing by the contractor,material &workmanship etc. and/ or non-performance of the work during the guarantee period.

NOW THE GUARANTOR hereby guarantees that the work executed by him shall perform to the specified standards of quality and workmanship during the guarantee period of ten years to be reckoned from the date of completion of work. During this period of guarantee, the guarantor shall make good all defects and if any defect is noticed during the guarantee period, it shall be rectified by the contractor within seven days of issue of notice to the contractor, at least temporarily, to the satisfaction of the Engineer-in-Charge, till the permanent rectification of the defects/replacement of defective materials is carried out by the contractor, in maximum four months period, retaining same aesthetic and other functional parameters of the original work. If not attended to,the same shall be got done by the Department through other agency at the risk and cost of the contractor which shall be final and binding on the contractor.

That is the Guarantor fails to execute the necessary rectification or commits breach there under, then the Guarantor will indemnify the Principal and his successors against all loss, damage, cost expense or otherwise which may be incurred by him by reasons of any default on the part of GUARANTOR in performance and observance of this supplementary agreement. As to the amount of loss and/or damage and/or cost incurred by the Government, the decision of the Engineer-in-Charge will be final and binding on the parties.

IN WITNESS WHERE OF these presents has been executed by the
OBLIGATOR _____

And by and for and on behalf of the PRESIDENT OF INDIA on the day month and year first above written.

SIGNED, SEALED AND DELIVERED by OBLIGATOR in the presence of:

- 1.
- 2.

SIGNED FOR AND ON BEHALF OF THE PRESIDENT OF INDIA BY

In the presence of:

- 1.
- 2.

GUARANTEE TO BE EXECUTED BY CONTRACTOR FOR REMOVAL OF DEFECTS AFTER COMPLETION OF WORK IN RESPECT OF WATER PROOFING WORKS, FIRE DOORS WORK, ALUMINIUM WORK AND STONE CLADDING.

This agreement made this day of two thousand and

_____ between _____,

(Name of the contractor, hereinafter call Guarantor of the one part) and the PRESIDENT OF INDIA (hereinafter called the Government of the other part).

WHEREAS THIS Agreement is supplementary to a contract (hereinafter called the Contract) dated _____ and made between the GUARANTOR of the one part and the GOVERNMENT of the other part where by the Contractor inter alia, undertook to render the buildings and structures in the said contract recited completely water and leak proof.

AND WHEREAS THE GUARANTOR agreed to give a guarantee to the effect that the said structures will remain water / leak proof for ten years from the date of completion of work

NOW THE GUARANTOR hereby guarantees that water proofing treatment given by him will render the structures completely leak proof and the minimum life of such water proofing treatment shall be ten years to be reckoned from the date completion of work.

Provided that the guarantor will not be responsible for leakage caused by earthquakes or structural defects or misuse of roof or alterations and for such purpose

- a) Misuse of roof shall mean by operation, which will damage roofing treatment, like chopping of firewood and things of the same nature, which might cause damage to the roof.
- b) Alteration shall mean construction of an additional storey or a part of roof or construction adjoining to existing roof, where by roofing treatment is removed in parts.
- c) The decision of the Engineer-in-Charge with regard to cause of leakage shall be final.

During this period of guarantee, the guarantor shall make good all defects and in case of any defects being found, render the building water proof at his own cost, to the satisfaction of the Engineer-in-Charge and shall commence the work for such rectification within seven days from the date of issue of the notice from the Engineer-in-Charge calling upon him to rectify the defects, failing which the work shall be got done by Department through some other contractor at the GUARANTOR'S cost and risk. The decision of the Engineer-in-Charge as to the cost, payable by the Guarantor shall be final and binding.

That is the Guarantor fails to execute the necessary rectification or commits breach thereunder then the Guarantor will indemnify the Principal and his successors against all loss, damage, cost expense or otherwise which may be incurred by him by reasons of any default on the part of GUARANTOR in performance and observance of this supplementary agreement. As to the amount of loss and / or damage and / or cost incurred by the Government, the decision of the Engineer-in-Charge will be final and binding on the parties.

IN WITNESS WHERE OF these presents has been executed by the Obligator

and

by and for and on behalf of the PRESIDENT OF INDIA on the day month and year first above written.

SIGNED, SEALED AND DELIVERED by (OBLIGOR) in the presence of:

1.

2.

SIGNED FOR AND ON BEHALF OF THE PRESIDENT OF INDIA BY in the presence of:

- 1.
- 2.

FORM OF MODULAR KITCHEN

GUARANTEE BOND ON STAMPED PAPER

This agreement made this.....day of two thousand..... between M/s.....(hereinafter called the Guarantor of the one part) and the President of India (hereinafter called the Govt. of the other part).

Whereas this agreement is supplementary to the contract (hereinafter called the Contract) dated..... made between the Guarantor of the one part and Govt. of the other part, whereby the contractor inter alia, undertook to render the Buildings and structures in the said contract recited completely water and leak proof, stability, antitermite, water proofing, top finishing in good condition and structural defect free.

And whereas the Guarantor agreed to give a guarantee to the effect that the said structure will remain waterproof for ten years to be reckoned from the date after the maintenance period prescribed in the contract expires.

During this period of guarantee the Guarantor shall make good all defects and for that matter, shall replace at his risk and cost such members as may be damaged by water and in case of any other defect being found he shall render the building waterproof at his cost to the satisfaction of the Engineer-in-Charge and shall commence the works of such rectification within seven days from the date of issuing notice from the Engineer-in-Charge calling upon him to rectify the defects failing which the work shall be got done by the Department by some other contractor at the Guarantor's cost and risk and in the latter case the decision of the Engineer-in-charge as to the cost, recoverable from the Guarantor shall be final and binding.

That if the Guarantor fails to execute the waterproofing or commits breaches hereunder then the Guarantor will indemnify principal and his successors against all loss, damage, cost, expense or otherwise which may be incurred by him by reason of any default on the part of the Guarantor in performance and observance of this supplemental agreement. As to the amount of loss and/or damage and/or cost incurred by the Government the decision of the Engineer-in-charge will be final and binding on the parties.

In witness whereof of these presents have been executed by the Obligor.....and by..... For and on behalf of the President of India on the day, month and year first above written.

SIGNED, SEALED and delivered by OBLIGATOR in presence of :-

- 1.
- 2.

SIGNED for and on behalf of THE PRESIDENT OF INDIA by.....in the presence of :-

- 1.

- 2.

SECTION - 5
TECHNICAL SPECIFICATION

Item no:

Providing and laying controlled cement concrete M-250 and curing etc. complete including the cost of form work but excluding the cost of reinforcement for RCC work in (A) Footings (B)Column Pedastal below Plinth, (C)Beams(Tie).

1.0 Material and Workmanship:

The relevant specifications of item no 5.8.3 shall be followed for controlled concrete work as specified in item for M-250 and relevant specifications of item no 9.1 shall be followed for the formwork and centering work.

2.0 Mode of measurements and payments

2.1 The relevant specification of item no 5.8.3 shall be followed except that the item includes the cost of formwork and centering work for any cross sectional area.

2.1.1 The rate shall be for a unit of one cubic meter.

Mode of Measurement: on Cu.mt basis. Of concrete

Mode of Payment: on Cu.mt basis. **of concrete**

Item no:

Providing and laying controlled cement concrete M-200 and curing etc. complete including the cost of form work but excluding the cost of reinforcement for RCC work for (A) Beams (B) Lintel (C) Chajja (D) Slabs, sill, shelves (E) Columns etc. for all floors.

1.0 Material and Workmanship:

The relevant specifications of item no 5.8.1 shall be followed for controlled concrete work as specified in item for M-200 and relevant specifications of item no 9.7 and 9.1 shall be followed for the formwork and centering work.

2.0 Mode of measurements and payments

2.1 The relevant specification of item no 5.8.1 shall be followed except that the item includes the cost of formwork and centering work for any cross sectional area.

2.2.1 The rate shall be for a unit of one cubic meter.

Mode of Measurement: on Cmt basis.

Mode of Payment: on Cmt basis.

Item No:-

Providing & fixing in position standard extruded Aluminum Ventilator with louvers with anodized section for outer frame size 48 x 24 x 1.35 mm of approved shade louvers from aluminum standard section and providing rubber gasket around the glass allover including providing Glass 4 mm thick (Frosted or obscured on one side) fixed in channels including all required materials labours and equipments as per detailed drwg. as directed.

1.0 MATERIAL

1.1 Aluminum standard section

1.1.1 Main outer frame of rectangular tube

Aluminum alloy used in the manufacture of extruded Window section shall conform to I S designation HEA-WP of I S 733-1975 and also Designation WVG –WP of I S 1285-1975 section shall be as specified in the drawing and design

All sections shall be Free from any scratches or holes or any damages on surface. All section shall have finished luster surface on all sides

All sections shall be Free from any scratches or holes or any damages on surface. All section shall have finished luster surface on all sides

1.3 Glass

The glass shall be of approved make having thickness of 4 mm The glass shall be clear and free from scratches and cracks The glass shall be provided on the top

1.5. Rubber Gasket

Rubber gasket shall be of approved make. shall be Free from any scratches or holes or any damages on surface. and shall have finished luster surface on all sides

1.6. Fixtures

1.6.1 Hinges,

Hinges shall be of approved make. shall be Free from any scratches or holes or any damages on surface. and shall have finished luster surface on all sides

1.6.2 Handles,

Handles shall be of approved make. shall be Free from any scratches or holes or any damages on surface. and shall have finished luster surface on all sides.

1.1.4 Bolts,

All bolts shall be of approved make. shall be Free from any scratches or holes or any damages on surface. and shall have finished luster surface on all sides

2.0 WORKMANSHIP

The Work of aluminum window shall be done with extreme finishing. The partial board shall be fixed in the bottom panel and glass shall be fitted on top panel as directed by Engineer in charge using glazing clips

and rubber gaskets as required All the fixtures and fastenings shall be fitted at right place and as directed by Engineer in charge. Floor spring shall be fitted properly so as to align the window properly and shall be given trial of opening and closing properly.

3.0 Mode of Measurement & Payment :

3.1. The unit rate of aluminum Ventilator shall include the cost of all materials, cost of anodizing, cost of all necessary fixtures and fastenings, labour charges for fixing frames, windows and fixing the window in wall at the place shown in drawing and as instructed by Engineer in charge, all tools and plant required for assembling and fixing in position, finishing as per direction of the Engineer-in-charge, and all other incidental expenses for preparing window frame and shutter of specified size to complete the window structure or its components as shown on the drawings and according to these specifications. They shall also include the cost of making, fixing and making walls good by plaster patch colour etc as required

3.2. The ventilators shall be measured for its improvising and fixing aluminum colour anodized double shutters having standard extruded aluminum colour anodized hollow sections frame of size 48 x 24 x 1.35mm and providing rubber gasket and glazing clips around the glass all over including providing 25 mm thick decorative water proof pre-laminated pressed with fixing U type 2 mm thick and 4 mm thick (Frosted or obscured on one side) including all labour and equipments etc complete dimensions to those specified on plan or as directed.

3.3. The Ventilators shall be measured for its **length** and **breadth** limiting dimensions to those specified on plan or as directed.

3.4. The rate shall be for a unit of one square meter.

Item No.:-

Providing & laying water proofing treatment on terrace including applying neat cement slurry 2.75 Kg/Sqmt. on cement admixed with waterproofing component after cleaning the surface, laying cement concrete 50mm thick admixed With water proofing component over 20 mmthick layer of cm 1:5 to required slope including ramming at junction of wall and slabafter two days of proper curing applying a second coat of cement slurry finished the surface with 20 mm thick cm 1:4 china mosaic flooring and finally finished surface with white cement slurry after finishing with terrace shall be finished with water for a period of two week.As per specification..

(A) 50mm thick Cement Concrete(IPS)

The relevant specifications of item no 14.71(B)shall be followed for Cement Conrete IPS work as specified in item for IPS and relevant specifications of item no 14.71(B) shall be followed for The formwork.

**Material and Workmanship :
For China mosaic.**

The relevant specification of item No. 14.29/page no. 84 of GTS book shall be followed except that broken glaze of Ceramic tiles are to be used. The broken pieces shall be of china of approved colour size and manufacturer and the same shall not be polished but cleaned with water with mild Hydrochloric acid. Design/pattern/borders like flowers etc. may be done as required/directed by Engineer in charge.

Mode of Measurement and Payment.

Mode of Measurement of Smt. basis.

Item no:-

Providing and fixing 25mm thick both the sides polish kota stone shelves below platform, in store or in cupboards including fixing in position front edge machine cut polishing etc. complete As per specification.

Polished Kota Stone 25mm thick shall be approved quality size and specification in general for Kota stone shall be as per Item no. M –49/ Page 16 of standards specification booklet for building works.

Polished Kota stones are approved size shall be machine cut at front side with necessary groove shall be made in wall and polish kota stone shall be laid in line and level. Polish Kota stone shelves shall be fixed in cement mortar 1:3 (1 cement: 3 coarse sand) size of the polished kota stone shall be obtained as per the site measurement.

Necessary polishing shall be done to polish kota stone top and sides and as directed by Engineer-in-charge. Outer edges of stone shall be made round by polishing as directed groove made in wall shall made good fixed with white cement mixed with pigments to match with colour and stone.

Work includes cost of materials and labour with polishing complete.

Measurement shall be taken for visible dimensions in length and width and shall be paid for a unit of 1 sqmt.

Mode of Measurement: on Smt basis. . Of finished work

Mode of Payment: on Smt basis. . Of finished work



**Dy. Executive Engineer
Project Implementation Unit
Bhuj - Kutch**



**Executive Engineer
Project Implementation Unit
Bhuj - Kutch**

SECTION - 6
FORM OF BID

FORM OF BID

Description of the Works:

BID

To :

Address :

1. We offer to execute the Works described above and remedy any defects therein in conformity with the conditions of Contract, specification, drawings, Bill of Quantities and Addenda for the sum (s) of

(-----)

2. We undertake, if our Bid is accepted, to commence the Works as soon as is reasonably possible after the receipt of the Engineer's notice to commence, and to complete the whole of the Works in the Contract within the time stated in the document.
3. We agree to abide by this Bid for the period of 120 Days from the date fixed for receiving the same, and it shall remain binding upon it and may be accepted at any time before the expiration of that period.
4. Unless and until a formal Agreement is prepared and executed this Bid, together with your written acceptance thereof, shall constitute a binding contract between us.
5. We understand that you are not bound to accept the lowest or any tender you may receive.

Dated this----- day of ----- 20

Signature ----- in the capacity of -----

----- duly authorized to sign bids for and on behalf of -----

(in block capitals or typed)

Address

Witness

Address

Occupation



**Dy. Executive Engineer
Project Implementation Unit
Bhuj - Kutch**



**Executive Engineer
Project Implementation Unit
Bhuj - Kutch**

SECTION - 7
BILL OF QUANTITIES

BILL OF QUANTITIES

Preamble

1. The bill of Quantities shall be read in conjunction with the Instructions to Bidder, Conditions of Contract, Technical Specifications and Drawings.
2. The quantities given in the Bill of Quantities are estimated and provisional, and are given to provide a common basis for bidding. The basis of payment will be the actual quantities of work ordered and carried out, as measured by the Contractor and verified by the Engineer and valued at the rates and prices tendered in the priced Bill of Quantities, where applicable, and otherwise at such rates and prices as the Engineer may fix within the terms of the Contract.
3. The rates and prices tendered in the priced Bill of Quantities shall, except in so far as it is otherwise provided under the Contract, include all constructional plant, layout, supervision, materials, erection, maintenance, insurance, profit, taxes and duties, together with all general risks, liabilities and obligations set out or implied in the Contract.
4. The rates and prices shall be quoted entirely in Indian Currency.
5. A rate or prices shall be entered against each item in the Bill Quantities, whether quantities are stated or not. The cost of Items against which Contractor has failed to enter a rate or price shall be deemed to be covered by other rates and prices entered in the Bill of Quantities (in case of Item rate contract).
6. The whole cost of complying with the provisions of the Contract shall be included in the items provided in the priced Bill of Quantities, and where no Items are provided the cost shall be deemed to be distributed among the rates and prices entered for the related items of Work.
7. General direction and descriptions of work and materials are not necessarily repeated or summarized in the Bill of Quantities. References to the relevant sections of the contract documentation shall be made before entering rates or prices against each item in the Bill of Quantities.
8. The method of completed work of payment shall be in accordance with the specification for Road and Bridge works. For building works specifications for building are to be followed.
9. Errors will be corrected by the Employer for any arithmetic errors pursuant to **Clause 29** of the Instructions to Bidder.
10. Rock is defined as all materials which, in the opinion of the Engineer, required blasting, or the use of metal wedges and sledgehammers, or the use of compressed air drilling for its removal, and which cannot be extracted by ripping with a tractor of at least 150 kw with a single rear mounted heavy duty ripper.

BILL OF QUANTITIES

(A) Percentage Rate Tender (Up to INR 50 Cr.) SOR Year 20__-20__

Item No	Description of Item (with brief specification and reference to book of specifications)	Quantity	Unit	Rate In figures	Amount

I/We am/are willing to carry out the work at... % above/below percent(Should be written in figures and words) of the estimated rate mentioned above. Amount of my /our tender works out as under.

Estimated amount put to tender

Estimated amount put to tender

Deduct.....% below

Add.....% Above

Net

Net

In words

In words

(B) For Item Rate Tender (For above INR 50Cr.):SOR Year 20__-20__

Item No	Description of Item (with brief specification and reference to book of specifications)	Quantity	Unit	Rate		Amount
				In-figures	In-Words	

(A) Total Tendered Amount



(B) Rebate on above tendered amount (if any) % (in figure)

(in words).....

(C) Net Tendered Amount (A - B) (in figure)

(in words).....

#

1	The Contractor shall exhibit a board with detailed specification and details of work as directed by the Engineer-In-Charge for which no extra payment shall be made.
2	The labour cess will be deducted as per prevailing rules i.e. 1% of the work done.
3	GST and Income tax TDS will be deducted at a source while making payments of bills
4	In all R.C.C. Items in Rate Analysis Standard Cement Consumption has been taken as per Govt. G.R.: PRC-10/2017 Cement Consumption/16/C Date:11/05/2017 as stated in S.O.R.therefore in R.C.C.items where there is a change as per actual mix design the cost of difference of cement consumption have been deducted from the rate of original item at the rate of input rate mentioned in all the tender. Input rate is Rs. _____ MT.
5	GST extra applicable in case of work based on SOR 2024-25 only.
	<div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;">  Dy. Executive Engineer Project Implementation Unit Bhuj - Kutch </div> <div style="text-align: center;">  Executive Engineer Project Implementation Unit Bhuj - Kutch </div> </div>

SECTION - 8

SECURITIES AND OTHER FORMS

BID SECURITY (BANK GUARANTEE)

WHEREAS, ----- (name of Bidder) (hereinafter called the "The Bidder") has submitted his bid Dated ----- (Date) for the construction of ----- (Name of Contractor hereinafter called "the Bid")

KNOW ALL PEOPLE by these presents that We-----
(name of Bank)of ----- (name of country) having our
registered office at ----- (here in after called
"the bank") are bound unto **PIU General Fund A/C 11-114**(name of Employer)
(here in after called "TheEmployer")in the sum of ----- *

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

SEALED with the Common Seal of the said Bank this -----day of-----20

THE CONDITIONS of these obligations are:

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

Or

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

A Fails or refuses to execute the Form of Agreement in accordance with the
Instructions to Bidders, if required; or

B. Fails or refuse to furnish the Performance Security, in accordance with the
Instructions to Bidders; or

C. does not accept the correction of the Bid Price pursuant to Clause 27
(Correction of Errors)

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

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

DATE-----

SIGNATURE-----

WITNESS-----

SEAL-----

(Signature, name and address)

* The Bidder should insert the amount of the guarantee in words and figures
denominated in Indian Rupees. This figure should be the same as shown in
Clause 16.1(Bid Security) of the Instructions to Bidders.

****45 days** after the **end of the validity period** of the Bid. Date should be
inserted by the Employer before the Bidding documents are issued.

PERFORMANCE SECURITY

TO,

Principal Secretary, Health and Family Welfare Department (Name of Employer)
Chief Engineer (PIU), 4th Floor, NHM, PIU, RDD Bhavan, Civil Hospital Campus, Sector-12,
Gandhinagar (Address of Employer)

WHEREAS ----- (name and address of contractor) (hereafter called "the Contractor") has undertaken, in pursuance of Contracts No. ----- dates ----- to execute ----- (name of Contract and brief description of Works) (hereinafter called "The Contract")

AND WHEREAS it has been stipulated by you in the said Contract that the Contractor shall furnish you with a Bank Guarantee by a recognized bank for the sum specified therein as security for compliance with his obligation in accordance with the Contract.

AND WHEREAS we have agreed to give the Contractors such a bank Guarantee:

NOW THEREFORE we hereby affirm that we are the Guarantor and responsible to you on behalf of the Contractor, upto a total of ----- (amount of guarantee)* ----- (in words), such sum being payable in types and proportions of currencies in which the Contract prices is payable, and we undertake to pay you, upon your first written demand and without cavil or argument, any sum or sums within the limits of ----- (amount of guarantee) as aforesaid without your needing to prove or to show grounds or reasons for your demand for the sum specified therein.

We hereby waive the necessity of your demanding the said debt from the contractor before presenting is with the demand.

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

This guarantee shall be valid until 60 days from the date of expiring of the Defect Liabilities period.

Signature and Seal of the guarantor -----

Name of Bank -----

Address -----

Date -----

*An amount shall be inserted by the Guarantor, representing the percentage the Contract price specified in the Contract denominated in Indian Rupees.

ADDITIONAL PERFORMANCE SECURITY

[Clause 34.1. (A)]

TO,

Principal Secretary, Health and Family Welfare Department (Name of Employer)
Chief Engineer (PIU), 4th Floor, NHM, PIU, RDD Bhavan, Civil Hospital Campus, Sector-12,
Gandhinagar (Address of Employer)

WHEREAS ----- (Name and address of contractor) (hereafter called "The Contractor") has undertaken, in pursuance of Contracts No. ----- dates ----- to execute-----
----- (Name of Contract and brief description of Works) (hereinafter called "The Contract")

AND WHEREAS it has been stipulated by you in the said Contract that the Contractor shall furnish you with a Bank Guarantee by a recognized bank for the sum specified therein as security for compliance with his obligation in accordance with the Contract.

AND WHEREAS we have agreed to give the Contractors such a bank Guarantee:

NOW THEREFORE we hereby affirm that we are the Guarantor and responsible to you on behalf of the Contractor, upto a total of-----
(amount of guarantee) ----- (in words), such sum being payable in types and proportions of currencies in which the Contract prices is payable, and we undertake to pay you, upon your first written demand and without cavil or argument, any sum or sums within the limits of -----
(amount of guarantee) as aforesaid without your needing to prove or to show grounds or reasons for your demand for the sum specified therein.

We hereby waive the necessity of your demanding the said debt from the contractor before presenting is with the demand

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

This guarantee shall be valid until **28 days** from the project completion date.

Signature and Seal of the guarantor -----

Name of Bank -----

Address -----

Date -----

BANK GUARANTEE FOR ADVANCE PAYMENT

TO,

Principal Secretary, Health and Family Welfare Department (Name of Employer)

Chief Engineer (PIU), 4th Floor, NHM, PIU, RDD Bhavan, Civil Hospital Campus, Sector-12, Gandhinagar (Address of Employer)

----- (Name of Contractor)

Gentlemen:

In accordance with the provisions of the Conditions of Contract, sub-clause 51.1 ("Advance Payment") of the above-mentioned Contract,-----
----- (name and address of Contractor) (hereinafter called "the Contractor") shall deposit with (name of Employer) a bank guarantee his proper and faithful performance under the said Clause of the Contract in an amount of - (amount of Guarantee)*----- in words).

We, the ----- (bank of financial institution), as instructed by the Contractor, agree unconditionally and irrevocably to guarantee as primary obligator and not as Surety merely, the payment to-----
(name of Employer) on his first demand without whatsoever right of obligation on our part and without his first claim to the Contractor, in the amount not exceeding---
----- (amount of guarantee)* ----- (in words)

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

This guarantee shall remain valid and in full effect from the date of the advance payment under the Contract until ----- (name of employer) receives full repayment of the same amount from the contractor.

YOUR'S TRULY

Signature and Seal _____
Name of Bank/Financial Institution _____
Address _____
Date _____

* An amount shall be inserted by that Bank or Financial Institution representing the amount of the Advance Payment, and denominated in Indian Rupees.

Letter of Acceptance

(Letter head paper of the Employer)

_____(date)
To, _____(Name and address of the Contractor)

Dear Sirs,

This is to notify you that your Bid dated _____for execution of the _____(Name of the contract and identification number, as given in the Instructions to Bidders) for the Contract Price of Rupees _____ (_____) (amount in words and figures) as corrected and modified in accordance with the Instructions to Bidders* is hereby accepted by our agency.

You are requested to furnish performance security, in the form detailed in para 34.1 of ITB for an amount equivalent to Rs. _____within **10 days** of the receipt of this letter of acceptance up to beyond **60 days** from the date of expiry of defects Liability period i.e. upto _____and the Additional Performance Security for an amount equivalent to Rs. _____shall be valid beyond 28 (twenty-eight) days of Project Completion Date i.e. upto _____and sign the contract, failing which action as stated in Para 34.3 of ITB will be taken.

Yours Faithfully

Authorized Signature
Name and title of Signatory
Name of Employer

* Delete "Corrected and" or and modified if only one of these actions applies. Delete as corrected and modified in accordance with the Instructions to Bidders, if corrections or modifications have not been affected.

Issue of Notice to proceed with the work

(Letterhead of the Employer)

To, _____ (date)

_____(Name and address of the Contractor)

Dear Sirs,

Pursuant to your furnishing the requisite security in ITB Clause 34.1 and
signing of the Contract for the construction of _____

_____ at a bid Price of Rs.

_____.

You are hereby instructed to proceed with the execution of the said works in
accordance with the contract documents.

Yours faithfully

(Signature, name and title of signatory authorized
To sign on behalf of Employer)

AGREEMENT FORM

This agreement, made on the _____ day of _____ between _____ (name and address of Employer) (Hereinafter called "the Employer) and _____ (name and address of contractor) hereinafter called "the Contractor" of the other part.

Whereas the Employer is desirous that the Contractor execute

Name and identification number of contract (hereinafter called "the works") and the employer has accepted the Bid by the Contractor for the execution and completion of such works and the remedying of any defects therein, at a cost of Rs.

NOW THIS AGREEMENT WITNESSETH AS FOLLOWS

1. In this Agreement, words and expression shall have the same meanings as are respectively assigned to them in the conditions of contract hereinafter referred to and they shall be deemed to form and be read construed as part of this Agreement.
2. In Consideration of the payment to be made by the Employer to the contractor as hereinafter mentioned, the Contractor hereby covenants with the Employer to executive and complete the works and remedy any defects therein in conformity in all aspects with the provisions of the contracts.
3. The employer hereby covenants to pay the Contractor in consideration of the execution and completion of the works and the remedying the defects wherein contract price or such other sum as may become payable under the provisions of the Contract at the times and in the manner prescribed by the contract.
4. The Following documents shall be deemed to form and be ready and construed as part of this Agreement viz
 - i) letter of Acceptance
 - ii) Notice to proceed with the works:
 - iii) Contractor's Bid

- iv) Conditions of contract: General and Special
- v) Contract Data
- vi) Additional conditions
- vii) Drawings
- viii) Bill of Quantities and
- ix) Any other documents listed in the Contract
data as forming part of the Contract.

In witness whereof the parties there to have caused this Agreement to be
executed the day and year first before written

The Common seal of_____

Was hereunto affixed in the presence of:

Signed, sealed and Delivered by the said_____

In the presence of

Binding signature of Employer_____

Binding Signature of Contractor_____

UNDERTAKING
(For Investment)

I, the undersigned do hereby undertake that our firm M/s
..... would invest a minimum cash up
to **25%** of the value of the work during implementation of the contract.

(Signed by an Authorized officer of the firm)

Title of officer

Name of firm

DATE

UNDERTAKING

(For Validity)

I, the under signed do here by undertake that our firm M/s.....
..... agree to abide by this bid for a perioddays
for date fixed for receiving the same and it shall be binding on us and may be accepted at
any time before the expiration of that period.

(Signed by an Authorized officer of the firm)

Title of officer

Name of firm

DATE


Dy. Executive Engineer
Project Implementation Unit
Bhuj - Kutch


Executive Engineer
Project Implementation Unit
Bhuj - Kutch

SECTION - 9
DRAWINGS

SECTION - 10
DOCUMENTS TO BE FURNISHED BY BIDDER