

**PAITHAN MEGA FOOD PARK PVT. LTD.
AT PAITHAN (MH)**

**TENDER FOR CONSTRUCTION AND
INSTALLATION OF STORM WATER DRAIN**

BID NO.: PMFPPL – SWD – 01 – 2016



Paithan Mega Food Park Pvt. Ltd.

Nath House, Nath Road, Aurangabad-431005, Maharashtra

Project Management Consultants (PMC)



Abhyuday Techno Economic Consultants Pvt. Ltd.
211-212, Patel Avenue, Near Gurudwara
S.G. Highway, Thaltej, Ahmedabad – 380054, Gujarat

A/E Consultants



SEMAC Consultants Private Limited
'Conjeevaram House', 2nd Floor, 6-1-276,
Padmarao Nagar, Secunderabad – 500 025.

PAITHAN MEGA FOOD PARK PVT. LTD.

AT PAITHAN (MH)

BOOK NO. 1

Bid Information, General Conditions, Special Conditions, Appendix

BID NO. PMFPPL – SWD – 01 – 2016

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Section 3	: General Conditional of Contracts
Section 4	: Special Conditions of Contracts
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Section 1: Instruction to Bidders

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A. General

1. Scope of Bid

- a) Paithan Mega Food Park Private Limited, Aurangabad (referred to as Employer in these documents) invite bids for Construction & Installation of Strom Water Drains. (As defined in these documents and referred to as "the Works") detailed in Preface.
- b) The successful bidder will be expected to complete the works within a period of 6 months including rainy season.

2. Source of Funds: It is a Central Government aided project

3. Eligible Bidders

- a) Eligible Bidder's Qualification criteria
 - i. **The bidder should have satisfactorily completed at least one similar work (Construction & Installation of Strom Water Drains) with a contract value of at least Rs. 2.40 Crs or two similar works of Rs 1.50 Crs in any one of 12 month continuous period within last 5 financial years.**

The average annual turnover of the bidder should be more than Rs. 2.40 Crs for last three financial years.

The Bidders should have sound financial status, in support of which, the annual turnover statement of the preceding 3 years, Certified Balance sheet of the three proceeding 3 years for the previous year and Solvency Certificate from a Nationalised Bank shall be submitted.

- ii. The Solvency certificate shall be for a minimum amount equalling 20% of the quoted tender.
- iii. The bidder having successfully completed similar type of Industrial project of similar under reputed Consultants in last Five years. The bidder shall submit an attested copy of completion certificates of these projects.

The bidder shall also furnish details of work in hand on other contracts.

4. Forms of Bid and Qualification Information

- a) All bidders shall fill in Section 2, Forms of Bid and Qualification Information".

5. One Bid per Bidder

- a) Each bidder shall submit only one bid for one contract. A bidder who submits or participates in more than one Bid (other than as a Sub-contractor or in cases of alternatives that have been permitted or requested) will cause all the proposals with the Bidder's participation to be disqualified.
- b) Tender documents are not transferable

6. Cost of bidding

- a) 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

- a) The Bidder should visit the site and examine the Site of Works and its surroundings and obtain all information that may be necessary for preparing the Bid and entering into a contract for construction of the Works. The costs of visiting the Site shall be at the Bidder's own expense.

B. Bidding Documents

8. Contents of Bidding Documents

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

Book 1	:	Invitation for Bids containing Sections as below
<i>Section 1</i>	<i>:</i>	<i>Instructions to Bidders</i>
<i>Section 2</i>	<i>:</i>	<i>Forms of Bid and Qualification Information</i>
<i>Section 3</i>	<i>:</i>	<i>General Conditions of Contract</i>
<i>Section 4</i>	<i>:</i>	<i>Special Conditions of Contract</i>
<i>Section 5</i>	<i>:</i>	<i>Appendix</i>
Book 2	:	Bills of Quantity
Book 3	:	Tender Drawings
Book 4	:	Technical Specifications

- b) Only one set of original bidding document will be provided. The original documents prepared for submission have to be photocopied by the Bidder, for submission together with the Original.
- c) Each Bidder should submit one original documents & one duplicate document in all respect.
- d) Each Bidder should submit one copy of BOQ in Excel sheet in CD with financial bid.

9. Clarification of Bidding Document

- a) A prospective bidder requiring any clarification of the bidding documents may notify the Employer in writing or by fax 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 7 days prior to the deadline for submission of bids. Copies of the Employer's response will be forwarded to all purchasers of the bidding documents, including a description of the enquiry but without identifying its source.
- b) Pre-bid meeting
- i. The bidder or his official representative having authorization to attend, will be invited to attend a pre-bid meeting which will be arranged by the Employer. The purpose of meeting will be to clarify issues if any. The Bidder may send for points of clarifications with respect to tender if any by e-mail to Employer/ Consultants before Pre- bid meeting. Date, time and venue will be conveyed to the Bidder. **Pre bid meeting of this tender will be on 02nd April, 2016 at Nath House, Aurangabad at 11.00 Am.** The notice of Pre Bid Meeting shall be displayed on the employer's website. Bidders are advised to check the website routinely.

10. Amendment of Bidding Documents

- a) Before the deadline for submission of bids, the Employer may modify the bidding documents by issuing tender addends.
- b) Any addendum thus issued shall be part of the bidding documents and shall be communicated in writing through email or by fax to all the purchasers of the

bidding documents. Prospective bidders shall acknowledge receipt of each addendum by fax to the Employer. Addenda shall be incorporated in the bids submitted by the Bidder.

C. Preparation of Bids

11. Language of the Bid

- a) All documents relating to the bid shall be in the English language

12. Documents comprising the Bid

- a) The bid submitted by the bidder shall comprise the following:
 - i. The Bid (in the format indicated in Section 2) and the Bill of Quantities wherein the Bidder shall fill in the rates; original plus one photocopy
 - ii. EMD and Qualification Information Form and Documents; original plus one photocopy
 - iii. Originals only of Specifications and Drawing Volumes duly stamped on all pages by the Bidder
 - iv. Any other materials required to be completed and submitted by bidders in accordance with these instructions

All documents shall be filled in without exception. Supporting documents related to qualifying criteria shall be duly attested / notarised true copies.

13. Bid Prices

- a) The unit rate so quoted in the Bill of Quantity (BOQ) shall be applicable irrespective of any future change in quantities. Contractor has to quote for all items, if rate for any item/ items not quoted then Bid will be liable to reject.
- b) The quoted item rate shall include for all duties, taxes and other levies payable by the Contractor under the contract, and no claim whatsoever, in this respect shall be entertained by the Employer.
- c) The item rate quoted by the bidder shall be fixed during the tenure of the Contract.

14. Currencies of Bid and Payment

- a) The rates and the prices given are in Indian Rupees.

15. Bid Validity

- a) Bids shall remain valid for a period not less than 90 (Ninety) days from the last date for bid submission. A bid corrected by the Bidder as valid for a shorter period shall be rejected by the Employer as non-responsive.
- b) 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 additional period. The request and the bidders' responses shall be made in writing or by fax. 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 except as provided in 15(a) hereinafter, but will be required to extend the validity of his bid security for a period of the extension.

- c) The rates in BOQ shall remain fixed during the extended period of validity/extended period of contract.

16. Earnest Money Deposit:

- a) The Bidder shall furnish, as part of his Bid, an EMD of **Rs. 1.50 Lakhs** in favour of Paithan Mega Food Park Private Limited, Aurangabad and may be in one of the following forms:
 - i. A bank guarantee issued by a Nationalized / Scheduled Commercial banks notified by RBI (excluding co-operative / Rural banks)
 - ii. Demand draft or Bankers Cheque or Pay order drawn on Nationalized / Scheduled Commercial banks notified by RBI (excluding co-operative / rural banks) in favour of Paithan Mega Food Parks Private Limited.
- b) Bank guarantees issued as surety for the bid should be valid for 45 days beyond the validity of bid.
- c) Any bid not accompanied by an acceptable Bid Security and not secured as indicated in Sub-Clauses 16 (a) and 16(b) above shall be rejected by the Employer as non-responsive.
- d) The EMD of unsuccessful bidders will be returned within 30 days from the end of the bid validity period specified.
- e) The EMD of the successful bidder will be returned/ discharged when the bidder has signed the Agreement and furnished the required Performance Bank guaranty.
- f) The EMD may be forfeited
 - i. If the Bidder withdraws the Bid after Bid opening during the period of Bid validity.
 - ii. If the Bidder does not accept the correction of the Bid Price, pursuant to Clause 28.
 - iii. In the case of a successful Bidder, if the Bidder fails within the specified time limit to
 - a) Sign the Agreement or Furnish the required Performance Bank Guarantee.
- g) No interest shall be paid on any EMD/ Performance Bank Guarantee in lieu thereof.

17. Alternative Proposals by Bidders

- a) Alternative bids shall not be considered for any part of the Works.

18. Format and Signing of Bid

- a) The Bidder shall prepare the Bid as specified in clause 12 and following the instruction in clause 19.
- b) The original and copy of the Bid shall be typed or written in indelible ink and shall be signed by a person or persons duly authorized to sign on behalf of the Bidder. All pages of the bid where entries or amendments have been made shall be initialled by the person or persons signing the bid.

- c) The Bid shall contain no alterations or additions, except those to comply with instructions issued by the Employer, or as necessary to correct errors made by the bidder, in which case such corrections shall be initialled by the person or persons signing the bid.

D. Submission of Bids

19. Sealing and Marking of bids

- a) There shall be two parts for the bids, part 'A' and part 'B'. The part 'A' shall contain Technical part of the bid and Part 'B' shall contain financial part of the bid. The Bidder shall enclose the original and one photocopy of Part A in one envelope marking it as, Envelope-A, TECHNICAL BID-ORIGINAL and COPY. He will then enclose the original and one photocopy of Part-B in another envelope marking it as Envelope B, FINANCIAL BID ORIGINAL and COPY. These envelopes shall then be put inside one outer envelope.

Part 'A', Technical BID of the bid shall contain

- i. EMD as per tender requirement. If the EMD is not deposited the tender shall be declared as non-responsive and rejected
- ii. The Technical Qualification Information indicated in Section 2 duly filled in original and photocopy
- iii. Conditional Tender will be rejected outright.
- iv. Originals only of Book - 1 Conditions of Contract and Book - 3 Drawing volume duly stamped and initialled on each page by the bidder as proof of their having scrutinized the documents.

Part 'B', Financial bid shall contain

- i. Form of Bid duly filled in original plus photocopy
 - ii. Book - 2 Bill of Quantities wherein the Bidder shall fill in the unit rates in digits and words and each page duly signed and sealed
- b) The inner and outer envelopes shall
- i. Be addressed to the Employer at the following address:

20. Paithan Mega Food Park Private Limited

Nath House, Nath Road,
Aurangabad - 431005,
Maharashtra State

PMC Address : Abhyuday Techno Economic Consultants Pvt. Ltd., 211-212, Patel Avenue, Near Gurudwara, S.G. Highway, Ahmedabad-380054.

E-mail : pmc@abhyuday.in

- a) Bear the following identification
- i. Bid for Construction and Installation of Strom Water Drains.
 - ii. Bid Reference No.: PMFPPL - SWD - 01 - 2016
- b) In addition to the identification required in Sub-Clause 19 (b), the inner envelopes shall indicate the name and address of bidder.

- c) If the outer envelope is not sealed and marked as above, the Employer will assume no responsibility for the misplacement or premature opening of the bid.

21. Deadline for Submission of the Bids

- a) Bids must be received by the Employer at the address specified above no later than **17.30 Hours on 11th April 2016**. In the event of the specified date for the submission of bids declared a holiday for the Employer, the Bids will be received up to the appointment time on the next working day.
- b) The Employer may extend the deadline for submission of bids by issuing an amendment in accordance with Clause 10, in which case all rights and obligations of the Employer and the bidders previously subject to the original deadline will then be subject to the new deadline.

22. Late Bids

- a) Any Bid received by the Employer after the deadline prescribed in Clause 21 will be liable to rejection.

23. Modification and withdrawal of bid: No modification or withdrawals shall be permitted after submission. EMD shall not be refunded.

E. Bid Opening and Evaluation

24. Bid Opening: The received bids will be opened on next working day. Any changes in the date will be notified on the website.

25. Process to Be Confidential

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

26. Clarification of Bids

- a) To assist in the examination, evaluations and comparison of Bids, the Employer may, at his discretion, ask any Bidder for clarification of his Bid, including of the unit rates.
- b) Subject to sub clause 25 (a), no bidder shall contact the employer on any matter relating to its bid from the time of the bid opening to the time the contract is awarded. If the bidder wishes to bring additional information to the notice of employer, he should do so in writing.
- c) 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.

27. Examination of Bids and Determination of Responsiveness

- a) Prior to the detailed evaluation of Bids, the Employer will determine whether each Bid (a) meets the eligibility criteria defined in Clause 3; (b) has been properly signed; (c) is accompanied by the required securities and; (d) is substantially responsive to the requirements of the Bidding documents.
- b) A substantially responsive Bid is one which conforms to all the terms, conditions and specifications of the 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 right 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.
- c) If a 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.

28. Correction of Errors

- a) Bids determined to be substantially responsive will be checked by the Employer for any arithmetic errors. Errors will be corrected by the Employer as follows:
 - i. Where there is a discrepancy between rates in figures and in words, the rate in words will govern; and
 - ii. Where there is a discrepancy between the unit and the line item total resulting from multiplying the unit rate by the quantity, the unit rate as quoted will govern.
- b) The amount stated in the Bid will be adjusted by the Employer in accordance with the above procedure for the correction of errors and, with the concurrence of the Bidder, shall be considered as binding upon the Bidder, if the Bidder does not accept the corrected amount the Bid will be rejected and the Bid security may be forfeited in accordance with Sub-Clause 16.(f)

29. Short listing of Eligible Bids: The bids shall be evaluated for technical capability first. An empowered Tender Committee shall evaluate the qualification criteria based on internally decided scoring pattern and shall shortlist contractors based on the information and supporting evidence provided.

30. Evaluation of Bids.

- a) **The contractor shall be shortlisted on the basis of their technical bid.**
- b) The Employer will open, evaluate and compare the financial Bids only for shortlisted proposals (based on their technical evaluation) and take his decision for award of work. The process of Evaluation shall not be disclosed to any Bidder or others.
- c) Shortlisted contractor shall be invited for negotiations by the employer.
- d) The Employer reserves the right to accept or reject any variation, deviation from the bid document, or any alternative offer. Variations, deviations and alternative offers 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 into account in Bid evaluation

F. Award of Contract

31. Award Criteria

As per clause 30, the bids will be evaluated on technical and financial basis and the bidder will be selected on the basis of capability and price offer.

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

- a) Notwithstanding Clause 30, the Employer reserves the right to accept or reject any Bid or part of the Bid, and to cancel the Bidding process and reject all Bids, at any time prior to the award of Contract, without thereby incurring any liability to the affected Bidder or Bidders or any obligation to inform the affected Bidder of Bidders of the grounds for the Employer's action.

33. Notification of Award and Signing of Agreement

- a) 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 fax confirmed by registered letter. This letter (hereinafter and in the Conditions of Contract called the "Letter of Acceptance") will state the sum that the Employer will pay the Contractor in consideration of the execution, completion and maintenance of the Works by the Contractor as prescribed by the Contract (hereinafter and in the Contract called the "Contract Price").
- b) The notification of award will constitute the formation of the Contract, subject only to the furnishing of a performance Bank Guarantee in accordance with the provisions of Clause 33 (a) of Contract Price.
- c) The Agreement will incorporate all agreements between the Employer and the successful Bidder. It will be kept ready for signature of the successful bidder in the office of employer within 15 days of receipt of Letter of Acceptance; the successful Bidder will sign the Agreement and deliver it to the Employer.
- d) Upon accepting the Performance Bank Guarantee for the Successful Bidder and signing of the agreement, the employer shall issue a LOI / Notice to Proceed' to the Contractor, in which the date of commencement of the Contract shall be indicated.
- e) Upon furnishing of the Performance Bank Guarantee by the successful Bidder, the Employer will promptly notify the other Bidders that their Bids have been unsuccessful.

34. Performance Bank Guarantee

- a) Within 15 days of receipt of the Letter of Acceptance, the successful Bidder shall deliver to the Employer a Performance Bank Guarantee in any of the forms given below for an amount equivalent to 5% of the Contract price plus..
- b) A bank guarantee, Validity shall be **13 months** from the date of Mobilisation or up to completion of work, whichever is later in the form given in Section 2.

- c) Bank draft, in favour of Paithan Mega Food Park Private Limited, Aurangabad, payable at Aurangabad.
- d) If the Performance security is provided by the successful Bidder in the form of a Bank Guarantee, it should be issued by a Nationalized Bank or a Scheduled Bank in the format attached herewith.
- e) Failure of the successful bidder to comply with the requirements of sub-clause 33(b) shall constitute a breach of contract, cause for annulment of the award, forfeiture of the EMD, and any such other remedy the Employer may take under the contract and the Employer may resort to awarding the contract to the next ranked bidder.

35. Mobilisation Advances and Security

- a) The Employer will provide a Mobilisation Advance Payment, **maximum 10 % of the Contract Price** as stipulated in the Conditions of Contract. , as stated in the Contract Data, against submission of Bank Guarantee from Nationalised Bank or a Scheduled Bank only, validity of this BG should be **13 months** or up to complete recovery of Mobilisation advances or as decided by SPV at the time of negotiation with the party.

36. Corrupt or Fraudulent Practices

- a) The Employer expects the Bidders, Suppliers, Contractors and Consultants; observe the highest standard of ethics during the procurement and execution of such contracts. Therefore, the Employer
 - i. Defines, for the purpose of this provision, the terms set forth below as follows:
 - a) “corrupt practice” means the offering, giving, receiving or soliciting, directly or indirectly, of anything of value to influence the action of the Employer in the procurement process or in contract execution;
 - b) “fraudulent practice” means a misrepresentation or omission of facts in order to influence a procurement process or the execution of a contract;
 - c) “collusive practice” means a scheme of arrangement between two or more Bidders, with or without the knowledge of the Employer, designed to establish bid prices at artificial, non-competitive levels; and
 - d) “Coercive practice” means harming or threatening to harm, directly or indirectly, persons or their property to influence their participation in the procurement process or affect the execution of a contract.
 - ii. Will reject a proposal for award if it determines that the Bidder recommended for award has, directly or through an agent, engaged in corrupt, fraudulent, collusive or coercive practices in competing for the Contract in question;

SECTION - 2: FORMS OF BID, QUALIFICATION INFORMATION AND LETTER OF ACCEPTANCE, SECURITIES

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FORMATS	
- <i>Format for Credit Facility</i>	18
- <i>Letter of Acceptance</i>	19
- <i>Notice to Proceed with the Work</i>	20
- <i>Agreement Form</i>	21
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NOTE:-

* BOTH THESE FORMS ARE TO BE FILLED IN BY THE TENDERER AND SUBMITTED AS PART OF HIS BID.

Form 1: Contractor's Bid

This will be submitted with Financial Bid. In this book Bidder are requested to submit this letter without mentioning contract price.

Description of the Works : Construction & Installation of Strom Water Drains.
BID No. : PMFPPL - SWD - 01 - 2016.
To : Paithan Mega Food Park Private Limited.
Address : Nath House, Nath Road, Aurangabad - 431005, Maharashtra

GENTLEMEN,

Having examined the bidding documents including addendum, we offer to execute the Works described above in accordance with the Conditions of Contract, Specifications, Drawings and Bill of Quantities accompanying this Bid, for a contract price as submitted in Financial Bid.

This bid shall be valid for a period of 90 (Ninety) days from the day the bid is opened.

This Bid and your written acceptance of it shall constitute a binding contract between us. We understand that you are not bound to accept the lowest or any Bid you receive.

We hereby certify that we have taken steps to ensure that no person acting for us or on our behalf will engage in bribery.

We also undertake that, in competing for (and, if the award is made to us, in executing) the above contract, we will strictly observe the laws against fraud and corruption in force in India namely "Prevention of Corruption Act 1988"

We hereby confirm that this Bid complies with the Eligibility, Bid Validity and Bid Security required by the Bidding documents.

Yours faithfully,

Authorized Signature:

Name & Title of Signatory : _____

Name of Bidder : _____

Address : _____

Contractor No. : _____

Email ID : _____

Company Seal/ Stamp

Form 2: Qualification Information

The information to be filled in by the Bidder in the following pages will be used for purposes of Evaluation of Technical Submission as provided for in Clause 29 of the Instructions of Bidders.

The Contractor shall use this format and prepare the submission in as many pages as he wishes.

Particular care shall be taken to submit certification from the previous clients in support of the Bidder's claims. (The supporting documents should be duly attested or notarized)

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 construction work
Executed and payments received in the last three year
(In Rs. Crores)

2012--2013 _____ #

2013-2014 _____ #

2014-2015 _____ #

1.3.1 Work performed as prime contractor (in the same name) on works of a similar nature over the last three years.

<u>Project Name</u>	<u>Name of the Employer*</u>	<u>Description of work</u>	<u>Contract no.</u>	<u>Value of contract (Rs. Millions)</u>	<u>Date of issue of work order</u>	<u>Stipulated period of completion</u>	<u>Actual date of completion*</u>	<u>Remark explaining reasons for delays and work completed</u>

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:

<u>Description of work</u>	<u>Place & State</u>	<u>Contract No. & Date</u>	<u>Name and Address of Employer</u>	<u>Value of Contract (Rs. Millions)</u>	<u>Stipulated period of completion</u>	<u>Value of works* remaining to be completed (Rs. Millions)</u>	<u>Anticipated date of completion</u>
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)

1.5 Contractor's Plant, tool and Equipment essential for carrying out the Works shall be listed below

Contractor should engage all required tools and machinery, including Testing apparatus on site to execute the said work and the items in the BOQ (enclosed within this Tender)

- 1.6 Construction management and QC Organisation, Qualifications and experience of key personnel proposed for administration and execution of the Contract. Attach biographical data.

<u>Position</u>	<u>Name</u>	<u>Minimum Qualification</u>	<u>Years of experience(Years) (general)</u>	<u>Years of experience in the proposed position(Years)</u>
Project Manager -1		Engineering Graduate	15	8
Sr. Site Engineers-1		Engineering Graduate/Diploma	8-10	5
Site Engineers-1		Engineering Graduate/Diploma	4-7	3
Site Supervisors-1		Engineering Diploma/ITI	4-7	2

- 1.7 A statement regarding the number of Skilled and unskilled workers, the company has on its rolls at the time of tender submission. The statement also should indicate the number of skilled and unskilled workers proposed to be deployed on this project.

- 1.8 evidence of access to financial resources to meet the qualification requirements: cash in hand, lines of credit, etc. List them below and attach copies of support documents [sample format attached]

- 1.9 Name, address and telephone, telex and fax numbers of the Bidders' bankers who may provide reference if contracted by the Employer.

- 1.10 Information on litigation history in which the Bidder is involved.

<u>Other party('s)</u>	<u>Employer</u>	<u>Cause of dispute</u>	<u>Amount involved</u>	<u>Remarks showing Present status</u>

- 1.11 Statement of compliance under the requirements of Sub Clause 3.(a) of the instructions to Bidders.

- 1.12 Proposed work method and schedule of work demonstrating monthly targets so that the work is completed within the desired time frame. The Bidder should attach descriptions, drawings and charts as necessary to comply with the requirements of the Bidding documents.

SAMPLE FORMAT FOR EVIDENCE OF ACCESS TO OR AVAILABILITY OF CREDIT FACILITIES (ON THE LETTER HEAD OF BANK)**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 contract.

__Sd.__
Name of Bank
Senior Bank Manager
Address of the Bank

Letter of Acceptance
(Letterhead paper of the Employer)

To: _____ [name and address of the Contractor] _____-____-2014

Dear Sirs,

This is to notify you that your Bid dated _____ for execution of..... (Bid No.: PMFPPL - SWD - 01 - 2016) for the Contract Price of Rs. _____ (Rupees _____) as corrected and modified in accordance with the Instructions to Bidders' is hereby accepted by our Agency.

We note that as per bid, you do not intend to subcontract any component of work.

[OR]

We note that as per bid, you propose to employ M/s. as sub-contractor for executing

[Delete whichever is not applicable]

You are hereby requested to furnish Performance bank Guarantee for an amount of Rs. ----- within 15 days of the receipt of this letter of acceptance valid up to 28 day from the Defects Liability Period i.e. up to and sign the contract, failing which action as stated in Para 33 c of Section 1, clause 33c may be taken.

Yours faithfully,

Managing Director
Paithan Mega Food Park Private Limited

Issue of Notice to proceed with the work

(Letterhead of the Employer)

----- (date)

To

----- (name and address of the Contractor)

Dear Sirs:

Pursuant to your furnishing the requisite Bank Guarantee as stipulated in clause 33(a) Section 1 and signing of the contract agreement for.....@ a Bid Price of Rs. _____ (Rupees _____) you are hereby instructed to proceed with the execution of the said works in accordance with contract documents. The date of commencement will be _____.

Yours faithfully,

Managing Director
Paithan Mega Food Park Private Limited

Agreement Form**Agreement**

This agreement, made the _____, between Paithan Mega Food Park Private Limited (hereinafter called "the Employer") of the one part and _____ [name and address of Contractor] (hereinafter called "the Contractor") of the other part.

Whereas the Employer is desirous that the Contractor executes Construction & Installation of Strom Water Drains (Bid No. PMFPPL - SWD - 01 - 2016) (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 contract price of Rs. _____ (Rupees _____)

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 and construed as part of this Agreement.
2. In consideration of the payments to be made by the Employer to the Contractor as hereinafter mentioned, the Contractor hereby covenants with the Employer to execute and complete the Works and remedy any defects therein in conformity in all aspects with the provisions of the Contract.
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 the 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 read and construed as part of this Agreement, viz.:
 - i. Letter of Acceptance;
 - ii. Contractor's Bid;
 - iii. Book 1 containing Invitation to bid, General Conditions of Contract, Special Conditions of Contract, Appendix
 - iv. Book 2: Duly filled Bill of Quantities & Rates
 - v. Tender Drawings-Book 3 including Technical Specifications

In witness whereof the parties thereto 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 _____

Forms of Securities

Approved forms of Securities are attached here with. The performance and Mobilisation Advance are to be given by the successful bidder after the Employer issues the Letter of acceptance.

- Bank Guarantee in lieu of EMD with the Bid Submission
- Performance Bank Guarantee with letter of acceptance
- Bank Guarantee for Mobilisation Advance Payment (before receiving mobilization Advance)

BANK GUARANTEE IN LIEU OF EARNEST MONEY DEPOSIT

BANK GUARANTEE (To be executed on Stamp Paper of Rs.100/- or such higher value as per this Stamp Act of the State in which the Guarantee is issued. Stamp Paper should be in the name of the Nationalized Bank Issuing the Guarantee.)

To,
Paithan Mega Food Park Private Limited
Nath House, Nath Road,
Aurangabad - 431005, Maharashtra

1. In consideration of M/s. Paithan Mega Food Park Pvt. Ltd. (herein called "the Employer") having agreed to extend M/s _____ Contractor incorporated under the provision of the Companies Act, _____ demand, under the terms and conditions contained in the Tender No. _____ Dated _____ 2015 (hereinafter called "the said Tender") of Earnest Money Deposit for the due fulfilment by the said Parties of the terms and conditions contained in the said Tender, on the production of a Bank Guarantee for Rs. _____ (Rupees _____ Only) we, name of _____ Bank, address _____ (hereinafter referred to as "the Bank") do hereby undertake to pay to Employer an amount not exceeding Rs. _____ (Rupees _____ Only) against any loss of any breach by the said Party of any of the terms and conditions contained in the said tender.
2. We _____ (Name of Bank) do hereby undertake to pay the amounts due and payable under this guarantee without any demur, merely on a demand from the Employer stating that the amount claimed is due by way of damage caused, to or would be caused to or suffered by the Company by reason of any breach by the said Party of any of the terms of conditions contained in the said Tender or by reason of the party's failure to perform the said Tender. Any such demand made on the Bank shall be conclusive as regards the amount due and payable by the Bank under this guarantee.
3. We _____ (name of Bank), further agree to that the guarantee herein contained shall remain in full force and effect during the period that would be taken for the performance of the said Tender and that it shall continue to be enforceable till all the dues of the Company under or by virtue of the said Tender have been fully paid and its claims satisfied or discharged or till the Managing Director Paithan Mega Food Park Private Limited, Certifies that the terms and conditions of the said tender have been fully and properly carried out by the said Party and accordingly discharge the guarantee. Unless a demand or claim under this Guarantee is made on us in writing on or before the date. _____ we shall be discharged from all liability under this Guarantee thereafter.
4. We _____ (name of Bank), further agree with the Company that the Company shall have the fullest liberty without our consents and without affecting in any manner

our obligation hereby to vary any of the terms and conditions of the said Tender or extend time of performance by the said Party from time to time or to postpone for any time or from time to time any of the powers exercisable by the Company against the said Party and to forbear or enforce any of the terms and conditions relating to the said Tender and we shall not be relieved from our liability by reason of any such variation, or extension being granted to the said party or for any forbearance, act of omission on the part of the Company or any indulgence by the Company to the said party or by any such matter of thing whatsoever which under the law relating to sureties would but for this provision have effect of so relieving us.

5. We, _____ name of Bank, lastly undertake not to revoke this guarantee during its currency except with the previous consent of the Company in writing.

Notwithstanding anything contained hereinabove:

- a) The liability of the Guarantor under this guarantee is restricted to Rs _____ (Rupees _____ Only).
- b) This guarantee shall remain enforce until its expiry on _____.
- c) Unless a suit or action to enforce a claim under this guarantee is made against the rights within _____ months from the aforesaid date of expiry, i.e. _____ all the rights of the beneficiary under the said guarantee shall be forfeited and the guarantee shall be released and discharged and discussed from all liabilities thereof.

Witness

For _____

Signature _____

Seal

PERFORMANCE BANK GUARANTEE

PERFORMANCE BANK GUARANTEE (To be executed on Stamp Paper of Rs.100/- or such higher value as per this Stamp Act of the State in which the Guarantee is issued. Stamp Paper should be in the name of the Nationalized Bank Issuing the Guarantee.)

In consideration of the Paithan Mega Food Park Pvt. Ltd. (hereinafter called "the PMFPPL") having agreed to exempt M/s. _____ (hereinafter called "the said Contractor(s)") from the demand under the terms and conditions of an agreement dated _____ made between Paithan Mega Food Park Pvt. Ltd. and M/s. _____ for _____ work at Paithan Mega Food Park Pvt. Ltd, Aurangabad, (hereinafter called "the said Agreement") of security deposit for the due fulfilment by the said Contractor(s) of the terms and conditions contained in the said Agreement on production of a bank guarantee for Rs. _____ (Rupees _____) only.

We, _____ bank (hereinafter referred to as "the Bank") at the request of M/s. _____ (Contractors) do hereby undertake to pay to the PMFPPL an amount not exceeding Rs. _____ (Rupees _____ only) against any loss or damage caused to or suffered by the PMFPPL by reason of any breach by the said Contractor(s) of any of the terms or conditions contained in the said Agreement.

We, _____ Bank do hereby undertake to pay the amounts due and payable under this guarantee without any demur, merely on a demand from PMFPPL stating that the amount claimed is due by way of loss or damage caused to or is likely to be caused to or suffered by the PMFPPL by reason of breach by the said Contractor(s) of any of the terms or conditions contained in the said Agreement or by reason of the Contractor(s) failure to perform the said Agreement. However, our liability under this guarantee shall be restricted to an amount not exceeding Rs. _____ (Rupees _____ only.)

We, _____ Bank undertake to pay to the PMFPPL any money so demanded notwithstanding any dispute or disputes raised by the Contractor(s) in whether any suit or proceedings before any Court or Tribunal or otherwise, relating thereto our liability under this present being absolute and unequivocal.

The payment so made by us under this bond shall be valid discharge of our liability for payment there under and the Contractor(s) shall have no claim against us for making such payment.

We, _____ Bank further agree that the Guarantee herein contained shall remain in full force and effect during the period that would be taken for the existence of the said Agreement and that it shall continue to be enforceable till all the dues of PMFPPL under or by virtue of the said Agreement have been fully paid and its claims satisfied or discharged or till _____ whichever is late, or Paithan Mega Food Park Pvt. Ltd. has certified that the terms and conditions of the said Agreement have been fully and properly carried out by the said Contractor(s) and accordingly discharges this Guarantee. Unless a demand or claim under this Guarantee is made on us in writing on or before the _____ we shall be discharged from all liability under this Guarantee thereafter.

We, _____ Bank agree with the Paithan Mega Food Park Pvt Ltd shall have the fullest liberty without our consent and without affecting in any manner our obligations hereunder to vary any of the terms and conditions of the said Agreement or to extend time of performance of the said terms and conditions by the said Contractor(s) from time to time, or to postpone for any time or from time to time any of the powers exercisable by the PMFPPL against the said Contractor(s) and/or forbear or enforce any of the terms and conditions relating to the said Agreement and we shall not be relieved from our liability by reason of any such variation or extension being granted to the said Contractor(s) or for any forbearance, act or omission on the part of the PMFPPL or any indulgence by the PMFPPL to the said Contractor(s) or by any such matter or thing whatsoever which under the law relating to sureties would, but for this provision have effect of so relieving us.

The Guarantee will not be discharged due to the change in the constitution of the Bank or the Contractor(s).

We, _____ Bank lastly undertake not to revoke this Guarantee during its currency except with the previous consent of the PMFPPL in writing.

Dated this _____ day of _____

PERFORMANCE BOND FOR UNBALANCED ITEMS

Performance Bond will not be accepted.

BANK GUARANTEE FOR MOBILISATION ADVANCE PAYMENT

BANK GUARANTEE (ADVANCE) (To be executed on Stamp Paper of Rs.100/- or such higher value as per this Stamp Act of the State in which the Guarantee is issued. Stamp Paper should be in the name of the Nationalized Bank Issuing the Guarantee.)

To,
Paithan Mega Food Park Pvt. Ltd.
Nath House, Nath Road,
Aurangabad-431005, Maharashtra

With reference to your Letter, Order No.....Dated.....Concluded between Paithan Mega Food Park Pvt Ltd hereinafter referred to as "Employer" and M/s.....hereinafter referred to as "The Contractor" for Civil Construction of Paithan Mega Food Park Pvt Ltd . as detailed in the above contract, herein after referred to as "The said contract" and in consideration of the Employer having agreed to make an advance payment, in accordance with the terms of the said contract to the said Contractor. We "The Bank" hereby irrevocably undertake and guarantee to you that if the said Contractor would fail to complete Civil Construction work in conformity with the terms of the said contract for any reason whatsoever or fail to perform the said contract in any respect or should the whole or part of the said on account payment at any time become repayable to you for any reason whatsoever, we shall, on demand and without demur pay to you all and any sum up to a maximum of Rs.....

We further agree that the Employer shall be the sole judge as to whether the Contractor has failed to abide by the terms of said contract or has failed to perform the said contract in any respect or the whole part of the on account payment made by the Employer has become repayable.

- d) We further hereby unconditionally undertake to pay the amount due and payable under this guarantee without any demur merely on a demand from the Employer stating the amount claimed. Any such demand made on the bank shall be conclusive and binding upon us. The liability of the Guarantor under this guarantee is restricted to Rs_____ (Rupees_____ Only).

We further agree that this Guarantee shall remain in full force for a period ofMonths unless it is released by you, on an application by Contractor made after the Bank Guarantee period has expired or such extended period of Guarantee, whichever is later, provided the Contractor has:

- (a) Completed Civil Construction work its obligations for Civil Construction work under the said Contract and adjusted the advance amount covered under this Guarantee.
- (b) Produced a Certificate of due completion of the aforesaid Civil Construction work under the said Contract.
- (c) Submitted a "No Demand Certificate" signed by your Managing Director.

Should it be necessary to extend this Guarantee beyond the said date we undertake to extend the period of this Guarantee without reference to the Contractor. Immediately after its lodging period or extended lodging period has expired, this document is to be returned

to us. No matter whether this document has been returned or not, no claim after the expiry of lodging period/ extended lodging will be accepted.

This Guarantee shall not be affected by any change in the Constitution of the Contractor or us nor shall it be affected by any change in your constitution or by any amalgamation or absorbable by the Absorbing/ amalgamated Company or concern.

We further agree that the Employer shall have the fullest liberty without affecting in any way our obligations hereby guaranteed us, as aforesaid, and we hereby expressly waive all our rights of surety ship and other rights if any which are in any way inconsistent with the above or any other provision of the guarantee.

We further agree that the Employer shall be the fullest without affecting in any way our obligation hereunder, with or without our consent or knowledge to vary any of the terms and conditions of the said contract or to extend the time of completion period from time to time or postpone for any time or from time to time any of the powers exercisable by the Employer against the Contractor and either of forbear or enforce any of the terms and conditions relating to the said contract and we shall not be relieved from our liability by reason of any such variation or any indulgence or forbearance shown or any act or omission on the part of the Employer or by any such matter or thing whatsoever under the law relating to sureties would but for this provision have the effect of so relieving us.

It shall not be necessary for you to proceed against the Contractor before proceeding against us and the Guarantee herein contained shall be enforceable against us, notwithstanding any security which you may have obtained or obtain from the Contractor at any time or when proceeding taken against us, hereunder, be outstanding or realized.

We further agree that this Guarantee shall come into force simultaneously with your making the said advance payment to the Contractor and shall not be revoked by us whether before its coming into force or any time during its currency without your previous consent in writing signed by your Managing Director.

Notwithstanding anything contained herein before, our liability under this guarantee is restricted to Rs.....(Rupees.....) and it will remain in force up tounless a suit to enforce any claim under this Guarantee is filed against us on or before (The claim lodging period should be 60 days beyond the date of expiry of Guarantee, Thus if the Guarantee is valid up to date_____ the claim lodging period should be _____, all your rights under this Guarantee shall be forfeited and we shall be relieved and discharged from all liabilities there under.

Dated this.....day of2015.

COUNTERSIGNED

WITNESS:

SIGNATURE: (BANK)

NAME:

SECTION 3 - GENERAL CONDITATION OF CONTRACT

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1. Interpretations

In construing these conditions, the specifications, schedule of quantities and the Contract Agreement, the following words shall have the meanings herein assigned to them except, where the subject or context otherwise requires.

- a) 'EMPLOYER/ OWNER 'shall mean Paithan Mega Food Park Pvt Ltd. having its registered office at Paithan and shall include their legal representatives, Assigns, successors or managing Committee or anyone authorized by them on their behalf
- b) 'CONTRACTOR' shall mean the tenderer and shall include his/ their legal representative/s, assigns/or successors
- c) 'PMC' shall mean M/s. Abhyuday Techno Economic Consultants Private Limited, 211-212, Patel Avenue, Near Gurudwara, S. G. Highway, Thaltej, Ahmedabad - 380054, Gujarat their nominees and also the Engineer-in-Charge or Engineer appointed by the Employer
- d) 'SITE' shall mean the site of the Contract works including any building and erections thereon and any other land (inclusively) as aforesaid allotted by the Employer for the Contractor' use
- e) 'THIS CONTRACT' shall mean the Articles of Agreement, the General Conditions, the Special Conditions, the Appendix, the Schedule of Quantities, Specifications drawings, and other letters attached hereto and duly signed
- f) 'NOTICE IN WRITING' or 'WRITTEN NOTICE' shall mean a Notice in writing, typed or printed characters sent (unless delivered personally or otherwise Proved to have been received) by registered post to the last known private or business address or registered office of the addressee and shall be deemed to have been received when in the ordinary course of post it would have been delivered
- g) 'ACT OF INSOLVENCY' shall mean any act of insolvency as defined by the Presidency Towns Insolvency Act, or the Provincial Act or any Act amending such original

Words importing the persons include firms and corporations

Words importing the singular only also include the plural and vice versa where the context requires

2. Scope of Contract

The Contractor shall carry out and complete the said work in every respect in accordance with this Contract and with the directions of and to the satisfaction of the Employer / PMC/Architect / Engineer-in-charge. The Architect and Engineer-in-Charge on their own may from time to time issue further drawings and/or written instructions, details, directions and explanations which are hereafter collectively referred to as "Works Instructions" in regard to:

- a) The variation or modification of the design, quality or quantity of works or the addition or omission or substitution of any work

- b) Any discrepancy in the Drawings or between the Schedule of Quantities and/or Drawings and / or Specifications
- c) The removal from the site of any material brought thereon by the Contractor and the substitution of any other material therefore
- d) The removal and / or, re-execution of any works executed by the Contractor
- e) The dismissal from the works of any persons employed thereupon
- f) The opening up for inspection of any work covered up
- g) The amending and making good of any defects under clause

The Contractor shall forthwith comply with and duly execute any work comprised in such works Instructions provided always that verbal instructions, directions and explanations given to the Contractor or his representative upon the works by the Architect and Engineer-in-charge shall, be confirmed in writing by the Contractor within seven days, and if not dissented from in writing within a further period of seven days, such shall be deemed to be "Works Instructions" within the Scope of the Contract

3. Inspection of Site

The Employer shall have made available to the Contractor such as data on sub-surface conditions as shall have been obtained by or on behalf of the Employer from investigations undertaken relevant to the Works, but the Contractor shall be responsible for his -own interpretation thereof and deemed to have visited the site and done own analysis.

4. Sufficiency of Tender

The Contractor shall also be deemed to have satisfied himself before tendering as to the correctness and sufficiency of his Tender for the works and of the rates and prices stated in the priced Bill of Quantities and the Schedule of Rates and Prices, which Tender rates and prices shall, except in so far as it is otherwise provided in the Contract, cover all his obligations under the Contract and all matters and things necessary for the proper execution and maintenance of the Works.

5. Program To Be Furnished

- a) Within the time stated of these Conditions, the Contractor shall, after the acceptance of his Tender, submit to the Engineer for his approval a program showing the order in which he proposes to carry out the works. The Contractor shall whenever required by the Engineer or Engineers' Representative, also provide in writing for his information a general description of the arrangements and methods which the Contractor proposes to adopt for the execution of the works
- b) If at any time it should appear to the Engineer that the actual progress of the works does not conform to the approved program referred to in sub-clause of this Clause, the Contractor shall produce, at the request of the Engineer, a revised

program showing the modifications to the approved program necessary to ensure completion of the works within the time for completion as decided and reworked to the satisfaction of the Employer

6. Drawings and Schedule of Quantities

The Copy of the Contract shall remain in the custody of the Employer. The Contractor on the signing thereof shall be furnished by the Architect with a copy of the priced Schedule of Quantities, one copy of each of the said drawings and the specifications and three copies of all further drawings issued during the progress of the work. The Contractor shall keep' one copy of all the Drawings on the works and Employer, Engineer-in-Charge or the Architect or his representative shall, at all reasonable-times, have access to the same. Before the issue of the Final Certificate to the Contractor, he shall forthwith return to the Architect all drawings and specifications, All the drawings supplied by the Architect will be in the form of Hardcopy.

7. Contractor To Provide Everything Necessary

The Contractor shall provide everything necessary for the proper execution of the works according to the intent and meaning of the Drawings, Schedule of Quantities and Specifications taken together whether the same may or may not be particularly shown or described therein provided that the same can reasonably be inferred there from and if the Contractor finds any discrepancy in the Drawings or between the Drawings, Schedule of Quantities and Specifications, he shall immediately and in writing refer the same to the Architect who shall decide which is to be followed

8. Authorities, Notices and Patents

The Contractor shall conform to the provision of any act of the Legislature relating to the works and to the Regulations and Bye-Laws of any Authority, and of any Water, Lighting and other Companies and/or Authorities with whose system the structure is proposed to be connected and shall, before making any variations from the Drawings or Specifications that may be necessitated by so conforming, give to the Architect written notice specifying the variation proposed to be made and the reason for making it, and apply for instructions thereon. In case, the Contractor shall not within twenty days receive such instructions, he shall proceed with the work, conforming to the Provisions, Regulations or Bye-Laws in question, and any variation so necessitated shall be dealt with under clause no.13

The Contractor shall bring to the attention of the Architect all notices required by the said Acts, Regulations or Bye-Laws to be given to any Authority and pay to such Authority or to any Public office all fees that may be properly chargeable in respect of the works, and lodge the receipts with the Architect

The Contractor shall indemnify the Employer and Architect against all claims in respect of patent rights, and shall defend all actions arising from such claims and shall himself pay all royalties, license fees, damages, costs and charges of all and every sort that may be legally incurred thereof.

9. Setting Out Works

The Contractor shall set out the works and shall be responsible for the true and perfect setting out of the same and for the correctness of the positions, levels, dimensions and alignment of all parts thereof. If at any time any error in this respect shall appear during the progress of the works, the Contractor shall at his own expense rectify such error if so required to the satisfaction of the Architect and the Engineer-in-Charge. The checking of any setting-out or of any line or level by the Engineer-in-charge or the Engineers representative shall not in any way relieve the contractor of his responsibility for the correctness thereof

10. Materials and Workmanship To Conform To Description

All materials and workmanship shall so far as procurable be of the respective kinds described in the Schedule of Quantities and/or Specification and in accordance with the "Works Instructions" and the Contractor shall, upon the request of the Employer/Architect, furnish him with all invoices, accounts receipts and other vouchers to prove that the materials comply therewith. The Contractor shall at his own cost arrange for and/or carry out any test of any materials which the Architect/ the Engineer-in-Charge may require

11. Contractors Superintendence And Representative On The Works

The Contractor shall give all necessary personal superintendence during the execution of the works, and so long thereafter as the Architect or Engineer-in-Charge may consider necessary until the expiration of the "Defects Liability Period" stated in the Appendix thereto. The Contractor shall also, during the whole time the works are in progress, employ a competent representative whose name is informed to the Employer/Architect who shall be constantly in attendance at the building while the men are at work. Any directions, explanations, instructions or notices given by the Architect or Engineer-in-Charge or Employer to such representative shall be held to be given to the Contractor. Such a person shall be a qualified engineer whose qualification and experience must be made known to the Architect / Engineer-in-charge and must have the approval

12. Dismissal of Workmen

The Contractor shall, on the request of the Architect or the Engineer-in-Charge or Employer, immediately dismiss from the works any person employed thereon by him who may, in the opinion of the Architect or the Engineer-In-Charge or the Employer, be incompetent or misconduct himself, and -such person shall not be again employed on the works without the permission of the Architect or Engineer-in-charge

13. Access To Works

The Architect and his representative or the Engineer-In-Charge or the Employer shall at all reasonable times have free access to the works and/or to the workshops, factories, or other places where materials are lying or from which they are being obtained and the Contractor shall give every facility to the Architect and his representative, the Engineer-In-Charge or the Employer necessary for inspections and examination and test of the materials and workmanship. Only persons authorized by the Architect, the Engineer-in-

Charge or the Employer, except the Representatives of Public Authorities, shall be allowed on the works at any time

14. Engineer-In-Charge/ The Engineer

The term 'Engineer-in-Charge' shall mean the person nominated by the employer and acting under the orders of the Employer/ to inspect the works. The Contractor shall offer the Engineer-in-Charge every facilities and assistance for the inspection of the works and materials and for checking and measuring the works carried out by the Contractor. The Engineer-In-Charge or any representative of the Employer shall have power to give notice to the Contractor or his representative of non-approval of any work or materials and such work shall be suspended or the use of such material be discontinued. The work will from time to time be examined by the Architect ' the Engineer-in-Charge or the Employer but such examination shall not in any way exonerate the Contractor from the obligation to remedy any defect which may be found to exist at any stage of the work or after the same is completed. In case of Contractor not removing the rejected material nor rectifying the defective work pointed out by the Engineer-in-Charge, the Contractor will be liable to the consequences as per the Agreement. The Contactor shall honour all letters, notices issued by the Engineer-In-Charge as if they are issued by the Architect. The Engineer-In-Charge may be empowered by the Architect to issue certificates for payment and the Employer shall honour such certificates provided the Architect has obtained a written consent from the Employer or has informed the Employer in writing.

15. Care of Works

- a) From the Commencement of the Works until the date stated in the Certificate of Completion for the whole of the works pursuant to Clause 48 (d) hereof the Contractor shall take full responsibility for the care thereof. Provided that if the Employer/Architect issues a Certificate of Completion in respect of any part of the Permanent Works the Contractor shall cease to be liable for the care of that part of the Permanent Works from the date stated in the Certificate of Completion in respect of that part and the responsibility for the care of that part shall pass to the Employer. Provided further that the Contractor shall take full responsibility for the care of any outstanding work, which he shall have undertaken to finish during the Period of Maintenance until such outstanding work is completed. In case any damage, loss or injury shall happen to the Works or to any part thereof, from any cause whatsoever, save and except the excepted risks as defined in sub-clause (b) of this Clause, while the Contractor shall be responsible for the care thereof the Contractor shall, at his own cost, repair and make good the same, so that at completion the permanent works shall be in good order and condition and in conformity in every respect with the requirements of the Contract and the Engineers instructions. In the event of any such damage, loss or injury happening from any of the excepted risks, the Contractor shall, if and to the extent required by the Engineer-in-charge and subject always to the provisions of the contract, repair and make good the same as aforesaid at the cost of the Employer. The Contractor shall also be liable for any damage to the Works occasioned by him in the course of any operations carried out by him for the purpose of completing any outstanding work or complying with his obligations under clause 48 hereof.

b) Excepted Risks

The "excepted risks" are war, hostilities (whether war be declared or not), invasion, and act of foreign enemies, rebellion, and revolution. insurrection or military or usurped power, civil war, employees of the Contractor or of his sub-contractors and arising from the conduct of Works, riot, commotion or disorder, or a cause solely due to the design of the Works or ionizing radiations or contamination by radio-activity from any nuclear fuel or from any nuclear waste from the combustion of nuclear fuel, radioactive, toxic explosive or other hazardous properties of any explosive, nuclear assembly or nuclear component thereof, pressure waves caused by aircraft or other aerial devices traveling at sonic or supersonic speeds, or any such operation of the forces of nature are collectively referred to as "the excepted risks".

16. Assignment and Sub-Letting

The whole of the works included in the Contract shall be executed by the Contractor and the Contractor shall not directly or indirectly transfer, assign or underlet the Contract or any part share thereof or interest therein without the written consent of the Employer/Architect and no undertaking shall relieve the Contractor from the full and entire responsibility of the Contract or from active superintendence of the works during their progress

17. Variation Not To Vitate Contract

No alteration, omission or variation shall vitiate this contract but in case the Architect and the Engineer-in-Charge in consultation with the Employer thinks proper at any time during the progress of the works to make any alterations in or additions to or omissions from the works or any alteration in the kind or quality of the materials to be used therein and shall give notice thereof in writing under his hand to the Contractor, the Contractor shall alter, add to or omit from as the case may require, in accordance with such notice, but the Contractor shall not do any work extra to or make any alterations or additions to or omissions from the works or any deviation from any of the provisions of the Contract, Stipulation, Specification or Contract Drawings without the previous consent in writing of the Engineer-in-Charge and the Employer jointly.

18. Schedule of Quantities

The schedule of Quantities, unless otherwise stated, shall be deemed to have been prepared as per mode of measurement specified in Technical Specification and Bill of Quantity attached with the Tender, Any error in description or in quantity or in omission of items from the Schedule of quantities shall not vitiate this Contract but shall be rectified and the value thereof as ascertained under Clause hereof shall be added to or deducted from the Contract Amount (as the case may be) provided that there shall be no rectification of errors in the Contractor's Schedule of Rates.

19. Sufficiency Of Schedule Of Quantities

The Contractor shall be deemed to have satisfied himself before tendering as to the correctness and sufficiency of his Tender for the works and of the prices stated in the Schedule of Quantities and / or the Schedule of Rates and Prices which rates and prices

shall cover all his obligations under the Contract, and all matters and things necessary for the proper completion of the works.

20. Measurement Of Works

The measurement and valuation in respect of the Contract shall be completed within "Period of final measurement" stated in the Appendix or if not so stated then within three months of the completion of the contract works as defined in Clause hereof.

21. Non Tender Items

The Contractor shall, when ordered in writing by the Architect and with the concurrence of the Employer, perform work not covered by the specifications or included in the Bills of Quantities but forming part of the work contracted for, on the same conditions in all respect in which he agrees to do the main work. Extra work and supply of such material shall be carried out at a rate settled by written agreement between the Contractor and the / the Engineer-in-Charge with the concurrence of the Employer.

22. Status of Workmen

None of the employees of the contractor shall be construed or deemed to be the employees of PMFFPL at any time and the Contractor shall indemnify and keep indemnified PMFFPL against any claim, loss or whatsoever in this connection.

There shall never exist any employer and employee relationship between PMFFPL and the manpower engaged by Contractor. PMFFPL shall not have any responsibility to nor shall be held directly or indirectly responsible or liable for the person so employed by the contractor for performing/providing services in terms of this agreement to PMFFPL in terms of its contractual obligations hereunder.

23. Quality of Materials & Workmanship and Tests

- a) All materials and workmanship shall be of the respective kinds described in the Contract and in accordance with the Engineer's instructions and shall be subjected to tests from time to time to such other place or places as may be specified in the Contract, or at all or any of such places. The Contractor shall provide assistance instruments, machines, labor and materials as are formally required for examining, measuring and testing any work and the quality, weight or quantity of any material used and shall supply samples of materials before incorporation in the work for testing as may be selected and required by the Engineer.
- b) Cost of Samples / Shop Drawings: All samples / shop drawings / fabrication drawings shall be supplied by the Contractor at his own cost.
- c) Cost of Tests: The Cost of making any Tests shall be borne by the Contractor.

24. Inspection of Operation

The Engineer and any person authorized by him shall at all times have access to the works and to all workshops on or off the site and places where work is being prepared

or from where materials, manufactured articles or machinery are being obtained for the works and the Contractor shall afford every facility for and every assistance in or in obtaining the right to such access. All works carried out off the site shall be duly brought to the notice of the Engineer.

25. Examination of work

- a) No work shall be covered up or put out of view without the approval of the Engineer or the Engineer's Representative and the Contractor shall afford full opportunity for the Engineer or the Engineer's Representative to examine and measure any work which is in view and to examine foundations about to be covered up or put out of before permanent work is placed thereon. The Contractor shall give due notice to the Engineer's Representative whenever any such work or foundation is or are ready or about to be ready for examination and the Engineer's Representative shall, without unreasonable delay, unless he considers it unnecessary and advises the Contractor accordingly, attend for the purpose of examining and measuring such works of examining such foundations.
- b) Uncovering & Making Openings: The Contractor shall uncover any part or parts of the works or make openings in or throughout the same part or parts to the satisfaction of the Engineer-in-Charge. If any such part or parts have been covered up or put off view after compliance with the requirements of sub-clause (a) of this Clause and are found to be executed in accordance with the Contract, the expenses of uncovering, making openings in or through, reinstating and making good the same shall be borne by the Employer, but in any other case all costs shall be borne by the Contractor.

26. Removal of improper Works and Material

- a) The Engineer-in-Charge shall during the progress of the works have power to order in writing from time to time
 - i. The removal from the Site, within such time or times as may be specified in the order, of any materials, which in the opinion of the Employer, are not in accordance with the Contract
 - ii. The substitution of proper and suitable materials and
 - iii. The removal and proper re-execution, notwithstanding any previous test thereof or interim payment thereof, any work which in respect of materials or workmanship is not, in the opinion of the Engineer, in accordance with the Contract

27. Default of Contract in compliance: In case of default on the part of the Contractor in carrying out such order, the Employer shall be entitled to employ and pay other persons to carry out the same and all expenses consequent thereon or incidental thereto shall be recoverable from the Contractor after giving due notice in writing by the Employer, or may be deducted by the Employer from any money due or which may become due to the Contractor

28. Suspension of Work

- a) The Contractor shall, on the written order of the Engineer, suspend the progress of the Works or any part thereof for such time or times and in such manner as the

Engineer may consider necessary and shall during such suspension properly protect and secure the work, so far as is necessary in the opinion of the Engineer. The extra cost incurred by the Contractor in giving effect to the Engineer's instructions under this clause shall be borne and paid by the Employer unless such suspension is

- i. Otherwise provided for in the Contract, or
- ii. Necessary by reason of some default on the part of the Contractor, or
- iii. Necessary by reason of climatic conditions on the site, or
- iv. necessary for the proper execution of the works or for the safety of the works or any part thereof in so far as such necessity does not arise from any act or default by the Engineer or the Employer or from any of the excepted risks defined in the clause hereof

Provided that the Contractor shall not be entitled to recover any such extra cost unless he gives written notice of his intention to claim to the Engineer within fifteen (15) days of the Engineer-in-Charge's Order. The Engineer shall settle and determine such extra payment and / or extension of time under clause hereof to be made to the Contractor in respect of such claim as shall, in the opinion of the Engineer-in-Charge, be fair and reasonable.

b) Suspension lasting more than 90 days

If the progress of the works or, any part thereof is suspended on the written order of the Engineer and if permission to resume work is not given by the Engineer within a period of ninety days from the date of suspension then, unless such suspension is within paragraph (i), (ii), (iii) or (iv) of sub-clause (a) of this clause the contractor may serve a written notice on the Engineer requiring permission within twenty-eight days from the receipt thereof to proceed with the works, or that part thereof in regard to which progress is suspended and, if such permission is not granted within that time, the Contractor by a further written notice so served may, but is not bound to, elect or treat the suspension where it affects part only of the works as an omission of such part under clause hereof, or, where it affects the whole works, as an abandonment of the Contract by the Employer.

29. Defects during execution and after completion of works

Any defect, shrinkage, settlement or other faults which may appear during execution or within the "Defects Liability Period" stated in the Appendix hereto, or if none stated then within 12 months after the virtual completion of the works, arising in the opinion of the Employer from materials or workmanship not in accordance with the contract, shall upon the directions in writing of the Employer, and within such reasonable time as shall be specified herein, be amended and made good by the Contractor, at his own cost unless the Architect & Engineer-in-Charge in concurrence with the Employer shall decide that he ought to be paid for such amending and making good, and in case of default the Employer may employ and pay other persons to amend and make good such defects, shrinkage, settlements or other faults, and all damages, loss and expenses consequent thereon or incidental thereto shall be made good and borne by the Contractor and such damage, loss and expenses shall be recoverable from him by the

Employer or may be deducted by the Employer upon the Architect's & Engineer-in-Charge's Certificate in writing from any moneys due or that may become due to the contractor, or the Employer may in lieu of such amending and making good by the Contractor deduct from any moneys due to the Contractor a sum to be determined by the Architect and the Engineer-in-Charge in concurrence with the Employer equivalent to the cost of amending such work and in the event of the amount retained by employer being insufficient recover the balance from the Contractor, together with any expenses the Employer may have incurred in connection therewith.

Should any defective work have been done or material supplied by any sub-contractor employed on the works, who has been nominated or approved by the Architect / the Engineer-in-Charge and the Employer jointly as provided in the clause, the Contractor shall be liable to make good in the same manner as if such work or material had been done or supplied by the contractor and been subject to the provisions of this clause and the clause thereof. The Contractor shall remain liable under the provisions of this clause notwithstanding the signing by the Architect or the Engineer-in-Charge or the Employer of any Certificate or the passing of any accounts

30. Insurance

Without limiting his obligations and responsibilities, the contractor shall insure in the name of the Employer against all loss or damage for all works under (a) below and in the joint name of the Employer and the Contractor against any loss or damage for all items under (b) below from whatever, cause arising, including riot and excepted risks and for which he is responsible under the terms of the Contract and in such manner that the Employer is covered for the period stipulated hereof and are also covered during the period of Maintenance for loss or damage arising from a cause, occurring prior to the commencement of the Period of Maintenance, and for any loss or damage occasioned by the Contractor in the course of any operations carried out by him for the Purpose of complying with his obligation under clause hereof:

- a) The Works for the time being executed to the estimated current contract value thereof, or such additional such as may be specified together with the materials for incorporation in the works at their replacement value.
- b) The Constructional Plant and other things brought on to the site by the contractor to the replacement value of such constructional plant and other things.
- c) Such insurance shall be affected with an insurer and in terms approved by the Employer and the Contractor shall, deposit with the Engineer or the Engineer's Representative the policy or policies of insurance and the receipts for payment of the current premiums. All money payable by insurers shall be received by the Employer and disbursed to the Contractor in instalments.

31. Damage to Persons & Property

The Contractor shall indemnify the Employer, PMC and the Architect against all claims in respect of injuries or damage to any person or material or physical damage to any property whatsoever which may arise out of or in consequences of the execution and maintenance of the works and against claims, proceedings, damages, costs, charges and expenses whatsoever in respect of but not limited to, to include payment of Wages Act

1936 (Latest), Minimum Wages Act 1948 (Latest), Employers Liability Act 1938 (Latest), Workmen's Compensation Act 1947 (Latest), Industrial Disputes Act 1947 (Latest), Maternity Benefit Act 1961 (Latest) The Contract Labour (Regulation and Abolition Act, 1970 and any modifications thereof or of any law relating thereof in relation thereto including any compensation or damages for or with respect to

- a) The permanent use of occupation of Land by the works or any-part thereof.
- b) The right of the Employer to execute-the works or any part thereof on, over, under, in or through any land.
- c) In case of any expenses arising from any such injury or damage to persons of employer and architects on site, the compensation shall be made by the contractor of the actual expenses without any delays which may arise out of claim filed and settled by the Insurance Company.

32. Third Party Insurance

- a) Before commencing the execution of the works the Contractor, but without limiting his obligations and responsibilities under clause hereof, shall insure against his liability for any material or physical damage, Loss or injury which may occur to any property, including that of the Employer, or to any person, including any employee of the Employer, by or arising out of the execution of the Works or in the work being carried out by the Employer, by or arising out of the referred to in provision hereof.
- b) Minimum amount of Third Party Insurance

Such insurance shall be affected with an insurer and in terms approved by the Employer, and for at least the amount stated in the Appendix to the Tender. The Contractor shall deposit with the Engineer or the Engineer's Representative the policy or policies of insurance and the receipts for payment of the current premiums.

- c) Provision to indemnify Employer

The terms shall include a provision whereby, in the event of any claim in respect of which the Employer would be entitled to receive indemnity under the policy being brought or made against the Contractor, the insurer will indemnify the Employer against such claims and any costs, charges and expenses in respect thereof.

33. Accident / or Injury to Workmen

- a) The Employer shall not be Liable for or in respect of any damages or compensations payable at Law in respect or in consequence of any accident or injury to any workman or other person in the employment of the Contractor or any sub-contractor.

The Contractor shall indemnify and keeps indemnified the Employer against all such damages and compensation and against all claims, proceedings, costs, and charges, whatsoever in respect thereof or relation thereto.

b) Insurance against Accident etc. to Workmen

The Contractor shall insure against such liability with an insurer approved by the Employer and shall continue such insurance during the whole of the time that any persons are employed by him on the works and shall, deposit with the Engineer or the Engineer's Representative such policy of insurance and the receipt of payment of the current premium.

Provided always that, in respect of any persons employed by any sub-Contractor, the Contractor's obligation to insure as aforesaid under this sub clause shall be satisfied if the sub-contractor shall have insured against the liability in respect of such persons in such manner that the Employer is indemnified under the policy, but the Contractor shall require such sub-contractor to deposit with the Engineer of the Engineer's Representative, such policy of insurance and the receipt for the payment of the current premium.

34. Remedy on Contractors Failure to Insure

If the Contractor fails to effect and keep in force the insurance referred to in clauses hereof, or any other insurance which he may be required to effect under the terms of the contract, then and in any such case the Employer may effect and keep in force any such insurance and pay such premium or premiums as may be necessary for that purpose and from time to time deduct the amount so paid by the Employer as aforesaid from any monies due or which may become due to the Contractor, or recover the same as a debt due from the contractor.

35. Commencement of Works

The Contractor shall commence the works on site within the period named in the Appendix to the Tender after the receipt by him a written order to this effect from the Engineer and shall proceed with the same with due expedition and without delay, except as may be expressly sanctioned or ordered by the Engineer. The time for commencement and completion of work shall be of the essence of the contract.

36. Possession of Site

- a) Save in so far as the Contract may prescribe, the extent of portions of the Site of which the Contractor is to be given possession from time to time and the order in which such portion shall be made available to him and, subject to any requirement in the Contract as to the order in which the Works shall be executed, the Employer will, with the Engineer's written order to commence the works, give to the Contractor possession of so much of the Site as may be required to enable the Contractor to commence and proceed with the execution of the works in accordance with the program referred to in Clause hereof, if any, and otherwise in accordance with such reasonable proposals of the Contractor as he shall, by written notice to the Engineer, make and will, from time to time as the works proceed, give to the Contractor possession of such further portions of the

site as may be required to enable the Contractor to proceed with the execution of the Works with due dispatch in accordance with said program or proposals, as the case may be. If the Contractor suffers delay or incurs cost from failure on the part of the Employer to give possession in accordance with the term& of this Clause, the Engineer shall grant an extension of time for the completion of the works. In case of dispute the Employer may ask the contractor to leave the site and hand over the possession of the site. The contractor shall do so immediately.

37. Time for Completion

Subject to the requirement in the Contract as to completion of any sections of the works before completion of the whole, the whole of the works shall be completed, in accordance with the provisions of clause hereof, within the time stated in the Contract calculated from the last day of the period named in the Appendix to the Tender as that within which the Works are to be commenced, or such extended time as may be allowed under clause hereof.

38. Rate of Progress

If for any reason, which does not entitle the Contractor to an extension of time, the rate of progress of the works or any section is at any time, in the opinion of the Engineer, too slow to ensure completion by the prescribed time or extended time for completion, the Engineer shall so notify the Contractor in writing and the Contractor shall thereupon take such steps as are necessary and the Engineer may approve to expedite progress so as to complete the Works or such section by the prescribed time or extended time. The Contractor shall not be entitled to any additional payment for taking such steps. If, as a result of any notice given by the Engineer under this Clause, the contractor shall seek the Engineer's permission to do any work at night or on Sundays, if locally recognized as days of rest, or their locally recognized equivalent, such permission shall not be unreasonably refused.

39. Liquidated Damages for Delay

If the Contractor fails to achieve completion of the works either in whole or part within the time prescribed, then the Contractor shall pay to the Employer the sum stated in the Appendix as liquidated damages for such default for everyday or part of a day which shall elapse between the time prescribed by clause hereof and the date of certified completion of the works. The Employer may, without prejudice to any other method of recovery, deduct the amount of such damages from any monies in his hands, due or which may become due to the Contractor. The payment or deduction of such damages shall not relieve the contractor from his obligation to complete the works or from any other of his obligations and Liabilities under the contract.

40. Certification of Completion of Works

- a) When the whole of the Works have been substantially completed and have satisfactorily passed any final test that may be prescribed by the Contract, the Contractor may give a notice to that effect to the Engineer or to the Engineers Representative accompanied by an undertaking to finish any outstanding work during the period of Maintenance. Such notice and undertaking shall be in writing and shall be deemed to be a request by the Contractor for the Engineer to

issue a Certificate of completion in respect of the works. The Engineer shall, within thirty days of the date of delivery of such notice either issue to the Contractor, a Certificate of Completion stating the date on which, in his opinion, the works were substantially completed in accordance with the Contract or give instructions in writing to the Contractor specifying all the work which, in the Engineer's opinion, requires to be done by the Contractor before the issue of such Certificate. The Engineer shall also notify the Contractor of any defects in the Works affecting substantial completion that may appear after such instructions and before completion of the works specified therein. The Contractor shall be entitled to receive such Certificate of Completion within twenty-one days of completion to the satisfaction of the Engineer of the works so specified and making good any defects so notified.

- b) Certification of completion by Stage
Similarly, in accordance with the procedures set out in Sub-clause (a) of this clause, the Contractor may request and the Engineer shall issue a Certificate of Completion in respect of
- i. Any section of the permanent works in respect of which a separate time for completion is provided in the Contract and
 - ii. Any substantial part of the Permanent Works, which has been both, completed to the satisfaction of the Engineer and occupied or used by the Employer.
- c) If any part of the Permanent Works shall have been substantially completed and shall have satisfactorily passed any final test that may be prescribed in the Contract, the Engineer may issue a Certificate of Completion in respect of that part of the Permanent Works before completion of the whole of the works and upon the issue of such Certificate, the Contractor shall be deemed to have undertaken to complete any outstanding work in that part of the works during the Period of Maintenance.
- d) Provided always that a Certificate of Completion given in respect of any section of part of the Permanent Works before completion of the whole shall not be deemed to certify completion of any ground or surfaces requiring reinstatements, unless Certificate shall expressly so state.

41. Period of Maintenance/ Defect Liability

a) **Period of Maintenance**

The expression "Period of Maintenance" shall mean the period of maintenance named in the Appendix to the Tender, calculated from the date of completion of the Works, certified by the Engineer in accordance with Clause hereof, or, in the event of more than one certificate having been issued by the Engineer under the said Clause, from the respective dates so certified and in relation to the period of Maintenance the expression "the Works" shall be constructed accordingly.

b) Execution of Work of repair, etc.

To the intent that the works shall at or as soon as practicable after the expiration of the Period of Maintenance be delivered to the Employer in the condition required by the Contract, fair wear and tear excepted, to the satisfaction of the Engineer, the Contractor shall finish the work, if any, outstanding at the date of completion, as certified under Clause 40 hereof, after such date and shall execute all such work of repair, amendment, reconstruction, rectification and making good defects, imperfections, shrinkages or other faults as may be required of the Contractor in writing by the Engineer during the Period of Maintenance, or within fourteen days after its expiration, as a result of an inspection made by or on behalf of the Engineer prior to its expiration.

c) Cost of execution of work of repair etc.

All such work shall be carried out by the Contractor at his own expense if the necessity thereof shall, in the opinion of the Engineer, be due to the use of materials or workmanship not in accordance with the Contract, or due to neglect or failure on the part of the Contractor to comply with any, obligations, expressed or implied, on the Contractor's part under the Contract. If, in the opinion of the Engineer, such necessity shall be due to any other cause, the value of such work shall be ascertained and paid for as if it were additional work.

d) Remedy on Contractor's Failure to carry out work required:

If the Contractor fails to do any such work as aforesaid required by the Engineer, the Employer shall be entitled to employ and pay persons to carry out the same and if such work is work which, in the opinion of the Engineer, the Contractor was liable to do at his own expense under the Contract, then all expenses consequent thereon or incidental thereto shall be recoverable from the Contractor by the Employer, or may be deducted by the Employer from any monies due or which may become due to the Contractor.

e) Contractor to search

The Contractor shall, if required by the Engineer in writing, search under the directions of the Engineer for the cause of any defect, imperfection or fault appearing during the progress of the works or in the period of Maintenance. Unless such defect, imperfection or fault shall be one for which the Contractor is liable under the Contract, the cost of the work carried out by the Contractor in searching as aforesaid shall be borne by the Employer. If such defect, imperfection or fault shall be one for which the Contractor is liable as aforesaid, the Cost of the work carried out in searching as aforesaid shall be borne by the Contractor and / he shall in such case repair, rectify and make good such defect, imperfection or fault at his expense in accordance with the provisions of clause hereof.

42. Payment Withheld

The Engineer may withhold or on account of subsequently discovered evidence nullify the whole or a part of any certificate to such extent as may be necessary in the opinion to protect the Employer from loss on account of

- a) Defective work not remedied.
- b) Failure of the Contractor to make payments properly to sub-contractor for materials or labour or to Contractor's employees / workmen or failure to discharge any other obligations under applicable laws.
- c) A reasonable doubt that the Contract cannot be completed in the balance time.
- d) Damage to another Contractor's or sub-contractor's work.
- e) Claims filed or reasonable evidence indicating probable filing of claims.

43. Delay and Extension of Time

If, in the opinion of the Employer, the works be delayed

- a) By force majeure or
- b) By reason of any exceptionally inclement weather or
- c) By reason of proceedings taken or threatened by or dispute with adjoining or neighboring owners or public authorities arising otherwise than through the Contractor's own default or
- d) By the works or delays of other Contractors or Tradesmen engaged or nominated by the Employer or the Architect / the Engineer-in-Charge and not referred to in the Schedule of Quantities and / or specification or
- e) By reason of "Works Instructions" as per Clause or
- f) By reason of civil commotion, local combination of workmen or strike or lockout affecting any of the building traders or
- g) in consequence of the Contractor not having received in due time necessary instructions from the Architect / the Engineer-in-Charge or the Employer for which he shall have specifically applied in writing, the Employer in consultation with the Architect / the Engineer-in-Charge shall make a fair and reasonable extension of time for completion of the Contract Works; in case of such strike or lock-out the Contractor shall, as soon as may be, give written notice thereof to the Architect, the Engineer-in-Charge and the Employer; but, the Contractor shall nevertheless constantly use his endeavors to prevent delay and shall do all that may reasonably be required to the satisfaction of the Architect / the Engineer-in-Charge and the Employer to proceed with the work.

44. Termination of Contract by the Employer

The Employer may terminate this contract by giving one month notice.

The Employer may terminate this contract, if the Contractor being an individual or a firm commit any "act of insolvency" or shall be adjudged an insolvent or being an Incorporated Company having an order for compulsory winding up made against it or pass an effective resolution forwarding up voluntarily or subject to the supervision of the Court and of the official Assignee of the Liquidator in such acts of insolvency or winding up shall be unable within seven days after notice to him requiring him to do so, to show to 'the reasonable satisfaction of the Architect / Owner with the concurrence of the Employer that he is able to carry out and fulfill the Contract, and to give security therefore, if so required by the Employer.

Or if the Contractor (whether an individual, firm or Incorporated Company) shall suffer execution to be issued.

Or shall suffer any payment under this Contract to be attached by or on behalf of any of the creditors of the Contractors,

Or shall assign or sub-let this Contract without the consent in writing of the Architect / the Engineer-in-Charge and the Employer first obtain,

Or shall change or encumber this Contract or any payments due or which may become due to the Contract there under;

Or if the Architect and the Engineer-in-Charge shall certify in writing the Employer that the Contractor

- a) Has abandoned the Contract, or
- b) has failed to commence the works, or has without any lawful excuse under these Conditions suspended the progress of the Works for 14 days after receiving from the Architect / the Engineer-in-Charge written notice to proceed, or
- c) Has failed to proceed with the works with such due diligence and failed to make such due progress as would enable the works to be completed within the time agreed upon, or
- d) has failed to remove materials from the site or to pull down and replace work for seven days after receiving from the Architect and the Engineer-in-Charge, written notice that the said materials or work were condemned and rejected by the Architect and the Engineer-in-Charge under these conditions, or
- e) has neglected or failed persistently to observe and perform all or any of the acts matters or things by this Contract to be observed and performed by the Contractor for seven days after written notice shall have been given to the Contractor requiring the Contractor to observe or perform the same, or
- f) has to the detriment of good workmanship or in defiance of the PMC/ Architect's/ Engineer-in-Charge's and Employer's instructions to the contrary sub-let any part of the Contract, then and in any of the said cases, the Employer in consultation with the Architect / the Engineer-in-Charge may not withstanding any previous waiver after giving seven days' notice in writing to the Contractor, determine the Contract, but without hereby affecting the powers

of the Architect / the Engineer-in-Charge or the obligations and liabilities of the contract, the whole of which shall continue in force-as fully as if contract had not been so determined and-as if the works subsequently executed had been executed by or on behalf of the contractor.

- g) The Employer under advice of the Engineer-in-Charge / Architect may enter upon and take possession of the works and all plant, tools, scaffoldings, sheds, machinery, steam and other power generation unit and materials lying upon the premises or the adjoining lands or roads, and use the same as his own property or may employ the same by means of his own persons and workmen in carrying on and completing the works or by employing any other Contractors or other person or persons to complete the works.
- h) The Contractor shall not in any way interrupt or do any act, matter or things to prevent or hinder such other contractor or other person or persons employed for completing and finishing or using the materials and plant for the works. When the works shall be completed or as soon thereafter as convenient the Architect and the Engineer-in-Charge shall give a notice in writing to the Contractor to remove his surplus materials and plant, and should the Contractor fail to do so within a period of fourteen days after receipt thereof by him, the Employer shall sell the same by public auction, and shall give credit to the Contractor for the amount realized. The Architect and the Engineer-in-Charge shall, thereafter, ascertain and certify in writing under their hands (if anything) shall be due or payable to or by the Employer for the value of the said plant and materials so taken possession of by the Employer and the expense or loss which the Employer shall have been put to in procuring the works to be completed, and the amount if owing to the Contractor and the amount which shall be so certified shall thereupon be paid by the Employer, as the case may be, and the certificate of the Architect and the Engineer-in-Charge shall be final and conclusive between the parties.

45. Termination of Contract by the Contractor

The Contractor may terminate this contract if the payment of the amount payable by the Employer under CERTIFICATE of the Architect and the Engineer-in-Charge with interest as provided for hereinafter shall be in arrears and unpaid for forty five days after notice in writing requiring payment of the amount with interest as aforesaid shall have been given by the Contractor to the Employer, or if the Employer interferes with or obstructs the issue of such Certificate or the Employer commits any "act of insolvency", or (being and Incorporated Company) shall have an order made against him or pass an effective resolution for winding up, either compulsorily or subject to the supervision of the Court or Voluntary, or if the official Assignee or the Employer shall repudiate the Contracts or if the official Assignee or the Liquidator, in any such winding up, shall be unable within fifteen days after notice to him requiring him so to do, to show to the reasonable satisfaction of the Contractor that he is able to carry out and fulfill the Contract and to make Contractor, to give security for the same, or if the works be stopped for all payments due, and to become due thereunder and, if required by the three months under the order of the Employer or by any injunction or other order of any Court of Law, then and in any of the said cases the Contractor shall be at liberty to determine the Contract by notice in writing to the Employer and he shall be entitled to recover from the Employer payment for all works executed.

In arriving at the amount of such payment, the net rates contained in the Tender Agreement shall be followed.

46. Certificates and Payments

- a) Unless otherwise provided, payments shall be made at monthly intervals in accordance with the conditions set out
- b) Advances on Constructional Plant and Materials

No advances are to be made by the Employer to the Contractor in respect of Constructional Plant and Materials, the conditions of payment and repayment shall be as set out.

- c) Approval only by Maintenance Certificate

No certificate other than the Maintenance Certificate referred to in clause D hereof shall be deemed to constitute approval of the works.

- d) Maintenance Certificate

The Contract shall not be considered completed until a Maintenance Certificate has been signed by the Engineer-in-Charge and delivered to the Contractor stating that the Works have been completed and maintained to his satisfaction. The Maintenance Certificate shall be given by the Engineer within twenty-eight days after the expiration of the Period of Maintenance, or, if different periods of maintenance shall become applicable to different sections or parts of the works, the expiration of the latest such period, or as soon thereafter as any works ordered during such period, pursuant to clause hereof, shall have been completed to the satisfaction of the Engineer and full effect shall be given to the clause, notwithstanding any previous entry on the works or the taking possession, working or using thereof or any part thereof by' the Employer. Provided always that the issue of the Maintenance Certificate shall be a precondition to payment to the Contractor of the second portion of retention money in accordance with the Appendix.

Cessation of Employer's Liability:

The Employer shall not be liable to the Contractor for any matter or thing arising out of or in connection with the Contract or the execution of the works, unless the Contractor has made a claim in writing in respect thereof before the giving of the Maintenance Certificate under this Clause

47. Valuation at Date of Forfeiture

The Engineer-in-Charge shall, as soon as practicable after any such entry and expulsion by the Employer, fix and determine ex parte, or by or after reference to the parties, or after such investigation or enquiries as he may think fit to make or institute, and shall certify what amount, if any, had at the time of such entry and expulsion been reasonably

earned by or would reasonably accrue to the Contractor in respect of work when actually done by him under the Contract and the value of any of the said unused or partially used materials and any Temporary Works

a) **Payment after Forfeiture**

If the Employer enters and expels the Contractor under this clause, he shall not be liable to pay to the Contractor any money on account of the Contract until the expiration of the Period of Maintenance and thereafter until the costs of execution and Maintenance, damages for delay in completion, if any, and all other expenses incurred by the Employer have been ascertained and the amount thereof certified by the Engineer-in-Charge. The Contractor shall then be entitled to receive only such sum or sums, if any, as the Engineer-in-Charge may certify as payable to him upon due completion by him after deducting the said amount. If such amount shall exceed the sum which would have been payable to the Contractor on due completion by him, then the Contractor shall, upon demand, pay to the Employer the amount of such excess and it shall be deemed a debt due by the Contractor to the Employer and shall be recoverable accordingly.

48. Urgent Repairs

If by reason of any accident, or failure, or other event occurring to in connection with the Works, or any part thereof, either during the execution of the works, or during the Period of Maintenance, any remedial or other work or repair shall, in the opinion of the Employer or the Engineer's Representative, be urgently necessary for the safety of the Works and the Contractor is unable or unwilling at once to do such work or repair, the Employer may employ and pay other persons to carry out such work or repair as the Engineer or the Engineer's Representative may consider necessary. If the work or repair so done by the Employer is work which, in the opinion of the Engineer, the Contractor was liable to do so at his own expense under the Contract, all expenses properly incurred by the Employer in so doing shall be recoverable from the Contractor by the Employer from any monies due or which may become due to the Contractor. Provided always that the Engineer or the Engineer's Representative, as the case may be, shall, as soon after the occurrence of any emergency as may be reasonably practicable, notify the Contractor in writing

49. Special Risks

The Employer shall repay to the Contractor any increased cost of or incidental to the execution of the Works, other than such as may be attributable to the cost of construction work condemned under the provision of clause hereof, prior to the occurrence of any special risk, which is however attributable to or consequent on or the result of or in any way whatsoever connected with the said special risks, subject however to the provisions in this clause hereinafter contained in regard to outbreak of war, but the Contractor shall as soon as any such increase of cost comes to his knowledge forthwith notify the Engineer thereof in writing.

a) **Special Risks**

The Special risks are war, hostilities, (whether war be declared or not), invasion, act of foreign enemies, the nuclear and pressure waves risk described in clause hereof, or insofar as it relates to the country in which the works are being or are to be executed or maintained, rebellion, revolution, insurrection, military or usurped power, civil war, or unless solely restricted to the employees of the contractor or of his sub-contractors and arising from the conduct of the works, riot, commotion or disorders.

b) Outbreak of War

If, during the currency of the Contract, there shall be an outbreak of war, whether war is declared or not, in any part of the world which, whether financially or otherwise, materially affects the execution of the works, the Contractor shall, unless and until the Contract is terminated under the provision of this clause, continue to use his best endeavors to complete the execution of the works. Provided always that the Employer shall be entitled at any time after such outbreak of war to terminate the Contract by giving written notice to the Contractor and, upon such notice being given, this contract shall, except as to the rights of the parties under this clause and to the operation of clause hereof, terminate, but without prejudice to the rights of either party in respect of any antecedent breach thereof.

c) Removal of Plant on Termination

If the Contract is determined under the provisions of the last preceding sub-clause, the Contractor shall, with all reasonable dispatch, remove from the site all Constructional Plant, staff, workers; identify those of Sub-Contractors to do so.

50. Payment if Contract is terminated

- a) The amounts payable in respect of any items, so far as the work or service comprised therein has been carried out or performed, and a proper proportion as certified by the Engineer in Charge in Writing of any such items, the work or service which has been partially carried out or performed.
- b) The cost of materials or goods reasonably ordered for the works which shall have been delivered to the Contractor at site or of which the Contractor is legally liable to accept delivery for works being fabricated off site, or propriety goods ordered in both cases where due prior notice has been given to the Engineer, in writing, such materials or goods becoming the property of the Employer upon such payments being made by him.
- c) A sum to be certified by the Architect & Engineer-in-Charge in writing being the amount of any expenditure reasonably incurred by the Contractor towards, site office, site stores, fabrication yard, fencing in the expectation of completing the whole of the works insofar as such expenditure shall not have been covered by the payments in this sub-clause before mentioned.
- d) On any account, if the Contract is terminated by Employer, no liquidated damages shall be payable to the Contractor on account of profit on remaining portion of the contract or loss on account of premature termination. In such a

case, the Contractor will be entitled to remove his material/equipment only after settling the account in full and final with Employer.

- e) Provided always that against any payments due from the Employer under this sub-clause, the Employer shall be entitled to be credited with any outstanding balances due from the Contractor for advances in respect of Constructional Plant and Materials and any other sums recoverable by the Employer from the Contractor under the terms of the Contract.

51. Frustration

a) Payment in the event of Frustration

If a war, or other circumstances outside the control of both parties, arises after the contract is made so that either party is prevented from fulfilling his contractual obligations, or under the law governing the Contract, the parties are released further performance, then the sum payable by the Employer to the Contractor in respect of the work executed shall be the same as that which would have been payable under clause 50 / 52 as the case may be hereof if the Contract had been terminated under the provisions of clause 50 hereof.

52. Procedure for Disputes

In case of Dispute or Difference arising between Employer and the Contractor relating to any matter arising out of this contract, such disputes or differences shall be settled in accordance with the Arbitration and Conciliation Act 1996, The Arbitral tribunal shall consist of 3 Arbitrators one each to be appointed by the Employer and the Contractor. The third arbitrator shall be jointly nominated by the two Arbitrators and he shall be the presiding arbitrator. If there is no agreement about nomination of the third Arbitrator, then the third and presiding Arbitrator shall be appointed by the Indian Council of Arbitrations/ president of Institute of Engineers.

The Arbitration proceedings shall be at Aurangabad and the operative language shall be English.

The decision of the Majority of Arbitrators shall be binding upon both parties. The Cost of Arbitration proceedings shall be shared equally by the parties. The expenses towards preparation and fees of Arbitrator by each party shall be borne by the parties themselves.

If the contract value is Rs 500 Lacs or less, the dispute shall be referred to a sole Arbitrator to be appointed jointly by the parties. If there is no agreement on this, the Sole Arbitrator shall be appointed by the Indian Council of Arbitration/president, Institute of engineers. Decision of the sole Arbitrator shall be binding on the parties.

Performance of the Contract shall continue during the Arbitration proceedings.

53. Safety Code

a) General

Contractor shall submit a Safety organization structure along with the Safety plan for approval before commencing the job.

Contractor shall adhere to safe construction practice and guard against hazardous and unsafe working conditions and shall comply with Owner safety rules as set forth herein prior to start of construction, Contractor shall be furnished copies of Owner's Safety Code' for information and guidance. The contractor shall erect, display and maintain signage at different locations of the site, to show safety requirements during work, regulations regarding protective equipment, clothing and the like.

b) Safety Regulations

- i. In respect of all labour, directly or indirectly employed in the work for the performance of Contractor's part of this agreement, the Contractor shall at his own expense arrange for all the safety provisions as per (i) Safety codes of C.P.W.D. & Indian Standards Institution (ii) The Electricity Act, (iii) The Mines Act, and (iv) Regulations, Rules and orders made there under and such other act as applicable
- ii. The Contractor shall observe and abide by all Fire and Safety Regulations of the Owner. Before starting construction work, Contractor shall consult Owner's safety engineer or Engineer-in-charge and provide all required precautionary measures to this effect. The Contractor must make good to the satisfaction of the Owner any loss or damage due to fire to any portion of the work done under this contract or to any of the Owner's existing property.
- iii. The contractor shall obtain necessary licenses and approvals from appropriate authority under labour enactment as required to carry out obligations under this contract including license required under The Contract Labour (Regulation and Abolition Act, 1970)

c) First Aid and Industrial Injuries

- i. Contractor shall maintain first aid facilities for his employees and those of his Sub-contractors. He shall arrange Medical Treatment without any loss of time in the event of an accident or injury.
- ii. All critical injuries shall be reported promptly to Owner. All such injuries shall be thoroughly investigated and a copy of Contractor's report covering - cause, remedy and preventive measures (for each personal injury requiring the attention of a physician) shall be furnished to the Engineer-in-Charge in an approved format.
- iii. The contractor shall have a trained person at the site for administering first aid.
- iv. The Contractor shall have a Safety Inspector for the works

54. Setting Up Of Field Laboratory

The Contractor shall set up a field laboratory at the site at his own expense to carry out the tests as per requirements

All required equipment as per relevant IS test procedure shall be available along with applicable IS codes. In addition to the above, the Contractor shall provide all other necessary equipments to carry out any other field tests required by the Engineer-in-charge.

All the equipments should be calibrated by a third party periodically and certificates should be kept in the laboratory.

The Contractor shall carry out the various mandatory tests as per BIS Specifications and the technical documents that shall be furnished to him during the performance of the work. All the tests, either on the field or outside laboratories concerning the execution of the work and supply of materials for the same shall be carried out by the Contractor at his own cost. Price quoted by the Contractor shall be deemed to include the cost of such tests and inspections.

55. Taxes

- a) The Rates in Bills of Quantities shall be inclusive of transporting, loading, unloading, storage, security & all other charges such as toll, Octroi, local taxes, excise duty, other payments and compensations, if any in connection with the procurement and handling of materials, fabrication and execution of works or any method or process connected with the works or Temporary works. However Service Tax & VAT shall be paid as per actual.
- b) Notwithstanding anything contained elsewhere in the contract, the Owner shall deduct at source, from the payments due to the Contractor, any taxes required to be deducted at source by law. The amounts so deducted shall be deposited by the Owner with the concerned authorities as per law. It is for the Contractor to deal with the concerned authorities directly in respect of any claim or refund relating to the above deductions and the Owner shall not be liable or responsible for any claims or payments or reimbursement in this regard.

56. Contractors Subordinate Staff and Their Conduct

- a) The Contractor on award of the work shall nominate and depute a qualified graduate engineer having sufficient experience in carrying out works of similar nature, as full time resident project manager of the Contractor for the work, to whom instructions for works may be given. The Contractor shall also provide to the satisfaction of the Owner/ Engineer-in-charge, sufficient and qualified staff to supervise the execution of the works, competent sub agents, foremen and leading hands including those specially qualified by previous experience to supervise the types of works comprised in the contract in such manner as shall ensure the best quality and expeditious working. At any time in the opinion of the Engineer-in-charge, any additional, qualified and experienced staff is considered necessary; they shall be employed by the Contractor without additional charge. The Contractor shall ensure to the satisfaction of the Engineer-in-charge that his Sub-

contractor's if any, shall provide competent and efficient supervision over the work entrusted to them.

- i. If any of the Contractor's agents, sub agents, assistants, foremen or any employee in the opinion of Engineer-in-charge be guilty of any misconduct or be incompetent or insufficiently qualified or negligent in the performance of their duties or that in the opinion of the Owner or the Engineer-in-charge, undesirable for administrative or any other reasons, for such person (s) to be employed on the works, then at the directions of Engineer-in-charge, the Contractor shall at once remove such persons(s) from employment at the works. The person(s) so removed from the works shall not again be employed in connection with the works without the written permission of the Engineer-in-charge. Vacancy so created shall be immediately filled at the expense of the Contractor by a qualified and competent substitute. Shall the Contractor be requested to repatriate any person removed from the works he shall do so and shall bear all costs in connection therewith?
- ii. The Contractor shall be responsible for the proper behaviour of all the staff, foremen, workmen and others, and shall exercise proper degree of control over them and in particular without prejudice to the said generality the Contractor shall be bound to prohibit / prevent any employees from trespassing in anyway detrimental or prejudicial to the interest of the community or the properties or occupiers of land or properties in the neighbourhood. In the event of such trespassing, the Contractor shall be responsible for all consequent claims or action for damages or injury or any other grounds whatsoever. The decision of the Engineer-in-charge upon any matter arising under this clause shall be final.
- iii. All employees of the Contractor shall be properly identified by badges of a type acceptable to the Owner, and must be worn at all times on the site.
- iv. Along with the tender, the bidder shall submit his schematic organization chart of staff to be employed at the works, along with their qualifications and experience.

b) Sub Letting Of Work

- i. No part of the contract be transferred, assigned or sublet by the Contractor directly or indirectly to any person, firm or corporation whatsoever except as provided for in the succeeding sub clauses without the consent of the Owner.

c) Sub-Contracting Of Works

- i. The Engineer-in-charge may give written consent to the Contractor for the execution of any part of the works/ specialized part of the works at the site, provided the Contractor submits credentials of each individual agency to the Engineer-in-charge for approval. Sub-contracting the work as a whole by the Contractor shall not be permitted. Furthermore, if it is

noticed by the Owner that the Contractor has not made payments to one or any agencies working under him, without prejudice to the other conditions herein, the Owner reserves the right to make such payments directly to the concerned agency after due verification.

d) Contractor's Liability Not Limited By Agencies To Contractors

- i. Notwithstanding any subletting with such approval as aforesaid and notwithstanding that the Engineer-in-charge shall have received copies of any sub contracts, the Contractor shall be and shall remain solely responsible for the quality and proper expeditious execution of the works and the performance of all the conditions of the contract in all respects as if such sub contract or subletting by the Contractor had not taken place, and as if such work had been done directly by the Contractor.

e) Owner May Terminate Sub Contracts Of Contractor

- i. If any Agency of contractor engaged upon the works at the site executes any work which in the opinion of the Engineer-in-charge is not in accordance with the contract, the Owner may by written notice to the contractor, request him to terminate such Agencies. The contractor upon the receipt of such notice shall terminate and dismiss the Agency. The Owner shall have the right to remove such Agency from the site if the Contractor fails to get the Agency immediately vacated.

f) No Relief For Action Under This Clause

- i. Action taken by Owner under the above clauses shall not relieve the Contractor of any of his liabilities under the contract or give rise to any right or compensation, extension of time or otherwise.

g) Contractor's Responsibility With Other Agencies

- i. Without repugnance to any other condition, it shall be the responsibility of the Contractor executing the work of civil construction to work in close cooperation and to co-ordinate in the works with the Piling, mechanical, electrical, air-conditioning, equipment, production machinery and intercommunication with other Contractors and other agencies or their authorized representatives, in providing the necessary grooves, recesses, cuts and openings etc. in wall, slabs, beams, and columns etc. and making good the same to the desired finish as per specification, for the placement of cables, conduits, air-conditioning inlets and outlets, grills and other equipment in the false ceiling and other partitions. The Contractor, before starting up the work shall in consultation, with the electrical, mechanical, equipment, inter communication, air-conditioning contractors and other agencies, prepare and put up a joint scheme, showing the necessary openings, grooves, recesses, cuts, the methods of fixing required for the works of the aforesaid, and the finishes therein, to the Engineer-in-charge and get the approval. The Contractor before finally submitting the scheme to the Engineer-in-charge shall have the written agreement of the other agencies. The Engineer-in-charge, before communicating his approval to the scheme, with any required modification shall get the final agreement

of all the agencies, which shall be binding. No claim shall be entertained on account of the above.

- ii. The Contractor shall conform in all respects with the provisions of any statutory regulations, ordinance or bye laws of any local or duly constituted authorities or public bodies which may be applicable from time to time to the works or any temporary works. The Contractor shall keep the Owner indemnified against all penalties and liabilities of every kind, arising out of non-adherence to such status, ordinances, laws, rules, regulations etc.

h) Other Agencies At Site

The Contractor shall have to execute the work in such place and condition where other agencies shall also be engaged for other works such as electrical and mechanical engineering works or other works etc. No claim shall be entertained due to work being executed in the above circumstances.

i) Serving Of Notices

i. To The Contractor

Any notice may be served on the Contractor or his duly authorized representative at the site or by registered mail directly to the postal address furnished by the Contractor at the time of tender. Proof of issue of such notice shall be conclusive of the Contractor having been duly informed of the contents therein.

ii. To The Owner

Any notice to be given to the Owner under the terms of the contract shall be served by sending the same by Registered mail to or delivering the same at the respective site office of the Owner addressed to the Engineer-in-charge.

57. Patents, Royalties, Liens

- a) The Contractor shall indemnify the Owner from and against all claims and proceedings for or on account of infringement upon any patent, design, trade mark or name or other protected rights in respect of constructional plants, machines or materials used for or in connection with the works, temporary works therefore or any part thereof, and from and against all claims demands, proceedings, damages, costs, charges and expenses whatsoever in respect thereof or in relation thereto.
- b) Liens
 - i. If at any time there shall be evidence or any lien, claim for which the Owner might have become liable, which is chargeable to the Contractor, and then the Owner may pay and discharge the same and deduct the

amount so paid by him, from any amount which may be or become due to the Contractor.

SECTION - 4: SPECIAL CONDITIONS OF CONTRACT

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1. General

The Contractor may please note that Special conditions hereinafter are part of the Contract Documents, which he shall fulfil in all respects. The cost towards these shall be included in BOQ rates. In case of variation the contents in Special conditions of contract shall take precedence over General Conditions of Contract.

2. Drawings

- (a) Tender Drawings issued with the Bid documents give details necessary to understand the work. Good for Construction Drawings shall be released as per project requirements to match the approved construction schedule
- (b) For structural steel fabrication work the Architect/Engineer shall issue the Design Drawings. Based on these the Contractor shall prepare fabrication Drawings as per BIS conventions and get the same approved from The Engineer. His approval shall however not relieve the Contractor of accuracy in details and dimensions. The Fabrication work shall start after such approval.
- (c) The fabrication drawings shall be in AutoCAD format. Contractor shall submit 3 hard copies and Digital files.

3. Addition/ reduction in scope of work

- (a) Any additional work within the site, instructed by The Engineer during the contract period shall be carried out by the Contractor as per BOQ rates. The Employer reserves right to reduce the scope of work in the contract

4. Water

- (a) Water shall be given by PMFFPL at one point at free of cost & all internal distribution arrangement shall be done by the Contractor at his own cost.. Contractor shall arrange to install the piping work and storage tanks, pumping as per requirement at his own cost. **Water for Labour colony shall be arranged by Contractor at his own cost.**

5. Electric power

- (a) Electric power for construction machinery, equipment, lighting at site shall be facilitated by PMFFPL at one point & all internal distribution shall be done by contractor at his own cost. The wiring/cabling/ earthing shall be safe and as per PWD Electrical Inspector's requirements. The installation shall be erected, operated, maintained and monitored on day to day basis by competent electrical supervisor. The contractor shall get a sub-meter installed and make the payments as per the readings.
- (b) DG sets of adequate capacity shall be installed, run and maintained so as to meet work quantum and schedule requirement by the contractor.
- (c) Necessary safety gear, gloves shall be available at site for the operating staff as provided by contractor.

6. Material testing lab at site

- (a) The Contractor shall provide at site and maintain and operate throughout the tenure of contract, Testing equipments for testing in situ, Hydro Pipe pressure test, gauges for thickness measurements etc. However other routine & non routine tests as required on request of the SPV Engineer/ PMC Engineer shall be carried out and shall be approved Third party in their laboratory, (all costs to be borne by contractor). Test apparatus shall be calibrated in approved laboratory periodically.
- (b) The Testing shall be manned and operated by qualified and experienced technicians.
- (c) All the tests as mentioned in the specifications and BOQ are mandatory & to be carried out as per standard practice, as per intimation or guidance of Engineer In Charge & to be submitted with R.A. Bills. R.A. Bill shall not be accepted without Test reports some of the test are given below.
 - 1. Hydrostatic Pipe Pressure Test.
 - 2. Flow Tests.
 - 3. Booster connection and pump tests.
 - 4. Leakage detection Tests.

7. Progress reports and photographs

- (a) Contractor shall prepare and submit following to The Engineer.

Daily Progress Report (DPR) giving details of man power, staff, plant and equipment, cement consumption (in email to SPV and PMC).

Weekly report giving details of major items of work executed, cement and steel consumed.

Monthly progress report giving details of work executed in the month ,month wise billing statement, value of work done in the month cement and steel consumed, stock position, review of construction schedule (M S Project), summary of action taken for Quality, planning of work in the next month and 8 photographs of work executed in the month.

The monthly report of the last month shall be submitted in the first week of current month.

8. Environment protection

- (a) Contractor shall take adequate measures to reduce dust, mud, and smoke and noise nuisance to people working at site and in the neighbourhood. Such measures shall inter alia include sheet barricade of adequate height, sprinkling water on aggregate storage, application of modern construction machinery and equipment meeting statutory provisions.
- (b) All the trees at site shall be thoroughly protected by guards as per requirement.

9. Site facilities

- (a) The Contractor shall establish his office, laboratory, stores, steel storage and fabrication yard, cement storage shed in watertight construction and of adequate capacity, drinking water facilities, sanitization facilities, rest room, crèche for his staff and workers. Proper access and internal roads for vehicular traffic in all-weather shall be provided by the contractor. As required lock and key arrangements shall be provided for all valuables.
- (b) Statutory approvals, licenses for above mentioned facilities shall be obtained and maintained by the contractor at his own cost.

10. Royalty

- (a) Royalty applicable on supply of building and quarried materials to site as also on excavation work at site shall be paid by the contractor and the Original copies of documents showing evidence of having paid the same shall be lodged with the Employer

11. Service tax and VAT

- (a) **The Service Tax and VAT, on the contract bills paid by the Employer-Contractor** have to submit the copy of challans. If copy of these Challans are not submitted for continuous two months or previous two consecutive R. A. Bills, then the amount shall be recovered from next R. A. Bill payment including any applicable penalty.

12. Measurement book

- (a) Measurements of work done shall be written jointly by The Engineer or his representative and contractor's Engineer and signed. The Book shall remain in the custody of The Engineer.
- (b) Measurements of work done in a particular month shall be completed before 7th day of the next month.
- (c) Contractor's Bill shall be accompanied by Xerox copies of duly signed measurements.

13. Monthly Running Bill:

Contractor shall prepare and submit monthly running bill covering work done in that particular month. The Engineer shall check, certify and forward to the Employer for further necessary action.

14. Terms of payment :

The payment terms for the payment applicable as below or decided as decided by SPV & Part at the time of negotiations

14.1 Mobilization advance

Mobilization advance of 10% of the contract value will be paid to the contractor against the Bank Guarantee of any Nationalized /Scheduled Commercial Banks notified by RBI (except co-operative/Rural Banks) valid for 15 months from the date of LOI / notice to proceed or up to the total recovery of Mobilization advance whichever is earlier.

10% mobilization advance will be deducted from second Running Bill till completion or in equal instalments.

After recovery of the total mobilization advance, the Bank guarantee received against the mobilization advance will be returned to the contractor.

14.2 Monthly R.A. Bill:

Monthly consolidated single bill should be presented for settlement. The R.A. Bills will be checked by EIC within a period of 15 days & certified by the Consultant within a period of 20 days and payment shall be made within 10 working days from the date of certification by Consultants and necessary deductions like 10 % Mobilisation advance, 5 % Retention money & any other payment made, Income tax as per Terms. All bills shall be submitted in soft copy as well as hard copy. The reconciliation of Cement & Steel to be submitted along with R.A. bill. All Test reports, J.M.R., Progress report with Photographs also to be submitted along with R.A. Bills. **Original Royalty Slips also needs to be submitted along with the bills. In failure of doing so, the employer will deduct the applicable royalty payment from the RA Bill amount.**

The Consultants shall be within his right to adjust and deduct the advances such that full recovery will be made at appropriate stage.

14.3 Retention Money:

5% contract value will be deducted as retention money from each RA bill (it shall be in addition to the Performance Bank Guarantee of 5% of the contract value).

On submission of final bill/Completion of the contract, the retention money will be released against the Bank guarantee of equivalent amount of any Nationalized/Scheduled Commercial Banks notified by RBI (except co-operative/Rural Banks) valid for 12 months defect liability period from the date of final completion of work/handing over of site.

Bank Guarantee will be returned after the expiring of the defect liability period i.e., 12 months from the date of completion of work/handing over of site.

14.4 Final Bill

Only on obtaining final completion certification from the Consultants & Employer, the Contractor shall submit the FINAL BILL which will be settled within a period of two months provided there is no dispute. The completion certificate will be issued only after all the defects pointed out are rectified completely to the satisfaction of the Consultants and the Employer. The reconciliation of all materials to be submitted along with the bill.

15. Quality assurance and Quality control

The Construction Quality Management is necessary to ensure that the Construction Quality meets or exceeds the intents of the technical specifications and drawings set forth in the Contract Documents. This is a system in which The Construction Manager

(contractor) and The Engineer in Charge (employer/consultant) perform defined tasks independently to achieve the Objective cited above.

- (a) Quality Control (QC) is regulatory process to be performed by the Construction manager and which includes following:
- (i) Specific standards are set for Construction performance, deduced or derived from the Technical Specifications/Drawings/Contract Conditions.
 - (ii) Construction methodology and planning and detailed time schedule.
 - (iii) Planning and deployment of appropriate resources like plant/ machinery/ manpower
 - (iv) Systems for workmanship in process supervision, checks and corrections.
 - (v) Testing of Construction Materials and site facilities.
 - (vi) Quantification of work done.
 - (vii) Meetings/workshops for safety and improvement in quality Plan
- (b) The Construction Manager prepares Quality Plan particular to the Project and same is finalized in conjunction with Engineer in Charge. The Quality Plan shall comprise of
- (i) QC Organization defines qualifications, hierarchy, authority and responsibility.
 - (ii) Construction method statement.
 - (iii) Procedure for material sample approvals.
 - (iv) workmanship checks for work in progress
 - (v) Material tests-standard/frequency/tolerances
 - (vi) Forms
 - (vii) procedure for interaction with Engineer in Charge
 - (viii) Bar Chart
 - (ix) safety manual
- (c) Quality Assurance (QA) includes defining criteria, applying procedures to ensure that QC system is effective .Thus the main functions of the Engineer in Charge are (1) to verify, vet contractor's Quality Plan and the QC system. (2) To monitor the working of QC systems. (3) Taking remedial measures in case of failures and strengthening the system

The Engineer in Charge makes his Quality Plan which comprises of

- (i) QA Policy and goal.
- (ii) QA standards and procedure, procedure for QA/QC interface.
- (iii) Development of QC norms specific to the project.
- (iv) Organization
- (v) Acceptance criteria
- (vi) Site surveillance and checks to control and prevent non conformities.
- (vii) Audit of completed work
- (viii) Maintaining QA records.
- (ix) Periodic internal QA/QC audits and remedial measures as per requirement.
- (x) Periodic joint site visits and meetings with the Construction Manager to sort out quality related matter.

16. Supply of Required Materials Like Pipes, Pumps, Pressure Gauge, Reels, Valves & Etc. for contract work

(a) The Contractor shall supply above materials at his own cost for contract work.

(b) Weighing, unloading at site, handling, storage, security and testing of samples in approved laboratory shall be done by the contractor and same shall be included in relevant item rates.

The Contractor shall maintain at all times proper records of material received, consumed and stock of all materials for use by the Contractor in the construction of civil works at the site.

17. The Material reconciliation statement shall be provided to the employer on demand only if needed.

18. Variations in Quantity and Non tender items

- (a) Even if the final quantity of work done differs from the BOQ quantity for the particular single item to any extent and this change causes variation in the Total Contract Price, there will not be any variation in the approved rates given in the attached BOQ.
- (b) Wherever applicable, the rates of non-tender items shall be deduced from similar items of work in BOQ and if this cannot be done then from DSR of Maharashtra State PWD for the nearest District HQ.

- (c) If above cannot be applied, then the Engineer shall arrive at the rate on the basis of actual cost incurred add 15% towards overheads, profits, transportation, handling, storage etc.

$L + M + 15\%$

L= Cost of Labour

M= Cost of Materials

- (d) For working out (18(c) above) the Contractor shall submit detailed analysis and supporting documents deemed necessary by the Engineer in advance and get the approval from the Engineer/ Employer before executing the work.

19. Completion period, completion certificate and taking over

- (a) The Contractor shall complete the contract works in all respects within the Completion period as per Appendix.
- (b) On completion of contract work, the contractor shall give a written Intimation to the Engineer to this effect. Joint Inspection by Employer, The Engineer, and contractor shall be done within 10 days of intimation and the punch list or defect list shall be prepared and signed. The defects shall be rectified within 14 days, again the rectifications work will be verified jointly. After all the defects are rectified to the satisfaction of Employer/the Engineer, Acceptance report will be signed jointly and the Employer shall take over the work within 7 days of signing the Acceptance report.

20. Defect liability

- (a) The Defect liability period shall be as per Appendix. The contractor shall be responsible to make good at his own expenses every defect which may develop during this period and which in the opinion of The Engineer is due to defective materials /defective workmanship/erroneous construction method.
- (b) The Employer shall intimate the defects in writing to the contractor and the contractor shall rectify the same within 7 days of such intimation. Failing this, the Employer shall be within his right to get such defects rectified from other sources and recover the cost from the retention amount.

21. Liquidated damages

- (a) The liquidated damages to be recovered from the contractor for delay in completing the work shall be as per Appendix.
- (b) This clause shall be applicable delay in Mile Stones if so stated in the Appendix.

22. Performance Bank Guarantee

- (a) Performance Security shall be provided by the contractor of an 5 % of Contract Value plus additional security for unbalanced Bids in accordance with Clause No. 21 of Appendix (section 5) to the Employer not later than the date given in the Letter of Acceptance. The amount, time period of keeping in force and banker shall be as specified in the Appendix. The performance security shall be by way of Bank Guarantee.
- (b) The format for the Bank guarantee shall be as per Tender Documents.

23. Labour and compliances with labour regulations

- (a) The contractor shall deploy adequate force of skilled and unskilled workers, foremen, supervisors of requisite skills to ensure quality construction as per schedule.
- (b) During the currency of contract, the contractor, his sub-contractors shall abide all existing or deemed statutory Labour Enactments, Rules, and Regulations as applicable.
- (c) The Contractor shall keep the Employer, The Engineer indemnified in case any action is taken by competent authority due to contravention of any Act/rules/regulations including amendments if any.

24. Spaces for quarters

- (a) The Employer shall provide Open Space at site for contractor's workers residential quarters. Contractor shall barricade such area, maintain sanitation and hygiene and completely vacate and hand over to the Employer within 15 days of termination of contract.
- (b) All Statutory permits shall be arranged by the Contractor at his cost. He shall keep the Employer indemnified from any penalties, legal sanctions that may be imposed by the Authorities in this matter.

25 Safety at site.

- (a) The Contractor shall maintain high quality safety standards to control and arrest accidents, injuries, occurrences of fire and resultant damages. The compliances in this regards have been listed and discussed herein after. The Contractor may make his assessment and add more items as may become necessary and prepare Contractor's Safety Plan for site operations. Such Plan shall be reviewed in conjunctions with the Engineer and modified to achieve higher standards
- (b) Contractor's Construction Manager shall set up Vigilance cum Safety Committee to implement and monitor the Safety Plan. The constitution of the committee shall be as follows :

Chairman	Construction Manager.
Coordinator	Safety officer/Engineer
Members - minimum 6.	Site engineers/supervisor/Foreman Two from each

-
- Transportation of heavy articles at site to be closely controlled to protect workers / nearby objects
 - The main switch boards shall have double earthing. All earth moving equipment to have effective earthing
 - Circuit breakers shall be used
 - Only armoured cable/ heavy rubber insulated cables of minimum 660 V grade shall be used
 - Adequate lighting arrangements to be made
 - All electrical installation shall be protected from rains/leaking water etc.
 - Cranes/earth moving equipment shall have audio-visual signalling during operation
 - Sturdy staging, platforms with railing shall be provided for work at elevation
 - First Aid boxes and one stretcher to be available throughout the day and night
 - Telephone and address of the nearest Hospital to be displayed in site office
 - Vehicle to be available for evacuating causality
- (h) In case of accident arrangements shall be done very fast for evacuation, first aid, and admittance to a Hospital
- (i) Proper records shall be maintained as required by the Factory Inspector

SECTION - 5: APPENDIX

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			<p>Mobilization advance, 5 % Retention money & any other payment made, TDS as per Terms. All bills shall be submitted in soft copy as well as hard copy. The reconciliation of Cement & Steel to be submitted along with R.A. bill. All Test reports, J.M.R., Progress report with Photographs to be submitted along with R.A. Bills. R. A. Bill is not accepted without Test Reports.</p> <p>The Consultants shall be within his right to adjust and deduct the advances such that full recovery will be made at appropriate stage.</p> <p>Deduction of 5% towards retention, 10% towards recovery of mobilization advance, payments already made and recovery of any other dues/income tax.</p>
5.	Final Bill-Clause 14.4 of Special Conditions of Contract	:	Final Bill shall be complete in all respects including duly signed final measurements, material reconciliation statements, authentication of non tender items by quantity and by rates agreed upon. Payment against final bill will be made as set out in Special Conditions of Contract-Clause14, after deducting full mobilization advance, 5% retention, other dues/TDS and recoveries.
6.	Time for Completion & Mile Stone : Clause19 of Special Conditions of contract	:	6 Months from date of LOI.
7.	Liquidated Damage-Clause 21 of Special conditions of contract	:	In the event of delay in completion of work, the contractor shall pay liquidated damages at the rate of 0.5% of contract price per week of delay subject to a maximum of 5% of contract price.
8.	Penalty	:	Rs.1,000/- per incident of unsafe act / non compliance of Legal / Statutory requirements as may be pointed out by the Consultants / Employer. Such fault shall also include acts that are specifically prohibited under various provisions / clauses provided as part of this tender document.
9.	Reconciliation of Material	:	The Contractor shall maintain at all times proper

			<p>records of material received, consumed and stock of all materials for use in the construction of civil works at the site.</p> <p>The Contractor shall also provide a proper reconciliation of the material consumed, duly verified by the Consultants / Employer, and along with the RA bills submitted from time to time and also Final reconciliation Statement with final Bill.</p>
10.	Contract Rates.	:	The Contract rates as per BOQ shall remain firm throughout the currency of the contract. No escalation or price adjustment shall be done due to any reason.
11.	Certified Payments - Clause 14 of Special Conditions of Contract	:	All payments made against the certificate issued by the Architect and Employer shall be deemed as advance payments. Payments made will not be construed as the items are complete and without any defects. Only on receiving completion certificate & settlement of final bill, the work shall be considered as complete and payment made against the final bill be considered as full payment against the work.
12.	Mobilization Time - Clause 14 of Special conditions.	:	The Contractor shall mobilize to the satisfaction of the Engineer and start construction work at site within a period of Ten Days from the date of LOI.
13.	Labour - Clause 23 Special Conditions	:	The Contractor shall comply with the provision of all relevant Acts of Central or State Govt. including Payment of Wages Act 1936, Minimum Wages Act 1948, Employer's Liability Act 1938, Workmen's Compensation Act 1923, Industrial Dispute Act 1947, Maternity Benefit Act 1961, Mines Act 1952, Employees State Insurance Act 1948, Contract Labour (Regulations & Abolishment) Act 1970 or PF Act 1952 any modification thereof or any other law relating thereto and rules made there under from time to time. No child labour should be employed at site.
14.	Insurance	:	<p>The Insurance Policies to be taken and kept in force by the contractor throughout the construction and defect liability period: These policies will be in joint names of contractor and Employer</p> <p>Theft/pilferage insurance for steel, cement at site</p>

			<p>and in contractor's custody. Contractor's Plant and equipment at site.</p> <p>Personal injury or death insurance-third party liability up to Rs. 10.00 lacs (Rupees Ten Lacs) per occurrence and covering 10 occurrences during the Contract.</p> <p>Personal injury or death Insurance for Contractor's staff, employees.</p> <p>Motor vehicle insurance including third party.</p>
15.	Notice to Local Bodies	:	The Contractor shall comply with and give notices required by any Government authority, instrument, rule or order made under any Act of Parliament, State laws or any regulation or bye-laws of any local authority relating to the works.
16.	Indemnification	:	<p>The contractor shall indemnify and keep the Employer indemnified against any liability in respect of :</p> <p>(i) Any fee or charges payable under any Act of Parliament, State Laws or any Govt. instrument, rule or order and any regulation or bye-laws of any local authority in respect of the works.</p> <p>(ii) Any loss or damage caused to any building road or fence of the company or any other party in the working area due to negligence of the contractor.</p>
17.	Licenses and local approvals	:	The contractor shall obtain at his cost Govt/Quasi Govt/Municipal licenses/permits required for labour, site facilities, construction work

18.	Mobilization advance Clause 14 of Special conditions of contract	Mobilization advance of 10% of the contract value will be paid to the contractor against the Bank Guarantee of any Nationalized /Scheduled Commercial Banks notified by RBI (except co-operative/Rural Banks) valid for 12 months from the date of LOI / notice to proceed or up to the total recovery of Mobilization advance whichever is earlier. 12% mobilization advance will be deducted from each Running Bill. After recovery of the total mobilization advance, the Bank guarantee received against the mobilization advance will be returned to the contractor.
19.	Supply of Materials and reconciliation. Clause no 16 of special conditions of contract Basic rates :	All required materials to execute the work as per mentioned in the BOQ and drawings and for items amended during contract period, if any. Should Be finalized At the Time Of Contract. All Materials to be procured should be approved by BIS, ISI and should be Confirming to NBC (Latest Revision) India. Contractor has to submit quotations & submit to PMFPPL / PMC in 15 days advance for their approval. Procurement shall be start after approval only.
20.	Site office & conference facilities-Clause 9 Special Conditions.	Contractor to provide lockable and properly ventilated site office of about 100 Sq.M. carpet area with toilet facility, pantry, electric supply for lighting and computers, fans etc... with conference facility, at his own cost.
21	Additional Performance Security for unbalanced Bids	If the Bid of the Successful Bidder is seriously unbalanced in relation to the Consultants 's estimate of the cost of work to be performed

		under the contract, the Employer may require the Bidder to produce detailed price analysis of any of all items of the Bill of Quantities to demonstrate the internal consistency of those prices with the construction. The employer may decide to seek additional performance bank guarantees for the bids.
22	Co-ordination with PEB Vendor & other Vendor	Coordination is requiring with PEB Vendor & other vendor.

**PAITHAN MEGA FOOD PARK PVT. LTD.
AT PAITHAN (MH)**

BOOK No. 2

Bill of Quantities (BoQ)

BID NO. PMFPPL – SWD – 01 – 2016



Paithan Mega Food Park Pvt. Ltd.

Nath House, Nath Road, Aurangabad-431005, Maharashtra

Project Management Consultants (PMC)



Abhyuday Techno Economic Consultants Pvt. Ltd.
211-212, Patel Avenue, Near Gurudwara
S.G. Highway, Thaltej, Ahmedabad – 380054, Gujarat

A/E Consultants



SEMAC Consultants Private Limited
'Conjeevaram House', 2nd Floor, 6-1-276,
Padmarao Nagar, Secunderabad – 500 025.

CLIENT : M/S PAITHAN MEGA FOOD PARK PVT LTD, C/O M/NATH BIO GENES (INDIA) LTD, NATH HOUSE, NATH ROAD, AURANGABAD.

PROJECT : PAITHAN MEGA FOOD PARK AT GUT.NO. 120 TO 126, DHANGAON & GUT NO. 53,55,56 & 62 /2 AT WAHEGAON VILLAGE PAITHAN TALUKA, DIST. AURANGABAD

TITLE / BUILDING NAME : SUMMARY

Code	Sl. No.	Description	Unit	Qty	Rate	Amount
	SWD - 1	Earth work in excavation in all types of soil including soft poclainable soil and soft disintegrated rock, in over areas by mechanical means (Hydraulic Excavator / manual means exceeding 1.5 m in width as well as 10 sqm on plan)including dressing of sides and ramming of bottom, getting out, stacking the excavated soil, filling the same in trenches, plinths, sides of foundations, basement and under floors, in layers not exceeding 200 mm in thickness, consolidating each deposited layer by ramming and watering, including dewatering of excess water if any in the excavated Trenches/ foundations by pumps etc., including disposal of surplus/ Unserviceable excavated soil as directed inside the site at the own arrangement of the contractor ,including loading and unloding and disposal of soil, disposed soil to be neatly levelled and dressed etc., complete as direceted at all levels and locations.				
e1a		a) For Lift up to 1.50 mt	Cum	17000		
e1b		b) For Lift above 1.5mt & Up to 3.0mt	Cum	2238		
		c) Hard Rock up to 1.5 meters Depth	CuM	RO		
		d) Hard Rock 1.5 meters to 3.0 meters Depth	CuM	RO		
c1	SWD - 2	Providing and laying plain cement concrete 1:3:6 (1 cement : 3 coarse sand :6 graded stone aggregate 20mm and down nominal size) including necessary shuttering in leveling courses under foundations, pipelines, pits, under floors etc., complete at all levels and locations and as directed by Engineer Incharge .	Cum	504		
	SWD - 3	Providing and laying in position M-25 grade reinforced cement concrete machine batched, machine mixed, and machine vibrated design mix cement concrete of specified grade with minimum cement content of 325 kg per cum of concrete and water cement ratio not more than 0.5 for reinforced cement concrete structural elements excluding the cost of centering, shuttering finishing and reinforcement, including adding admixtures in recommended proportion (as per IS 9103) to accelerate, retard setting of concrete improve workability without impairing strength and durability, and necessary curing etc.,complete all as directed at all levels and heights etc all complete .				

c4a		a) Footings , rafts and like	Cum	1112		
c4g		b) RCC walls and like	Cum	1530		
		c) RCC Slab	Cum	57		
	SWD - 5	Supply, Fabricating & fixing in position reinforcement for RCC work with Thermo mechanically (TMT) bar of various diameters and grade of steel as specified below conforming to IS specification including cutting, , bending, hoisting, fabricating and placing in position according to drawings and binding the reinforcement with GI annealed binding wire in two strands of 18 gauge and providing PVC cover blocks for placing the reinforcements in position and for maintaining the cover specified and/or according to relevant IS. Note : Unless noted otherwise the measurements in accordance with IS 1200. However reinforcement shall be measured only in lengths of bars as actually placed in position on standard weight basis, no allowance being made in the weight for rolling margin. Authorised laps and splices, chairs of any shape & profile,				
		Spacer bar of any shape & profile only will be measured and paid seperately.Cover block, wastage and binding wire shall be included in the quoted rate and to include lead, lift, placing at all levels and as per the approved bar bending schedule etc all complete				
c5		a) TMT bars of grade Fe-415 conforming to IS - 1786/85	MT	190		
	SWD - 6	Providing, fabricating and erecting form work at all levels and places wherever specified as per drawing including striking with 12mm waterproof marine ply/Smooth finished MS plates with adjustable steel props of acceptable Staging system and with sufficient bracing as approved by consultant. Cost to include designing of proper form work and staging system to suit the requirements,Submission of design calculations and shop drawings for approval,sealing the joints with heavy duty brown self adhesive tape, aligning to line and levels including M.S. Ties, PVC Spacer, Providing openings/ cutouts/ pockets, applying deshuttering chemical, Deshuttering as approved by the consultant etc., complete at all levels and heights				
c6a		a) Footings , rafts and like	Sqm	1500		
c6g		b) RCC walls and like	Sqm	25000		
		c) RCC Slab	Sqm	375		
	SWD - 9	Constructing manholes with 230 mm brickwork	Each	RO		
		Extra for additional depth of manhole	Rmt	RO		

wh	SWD - 11	Providing and fixing medium quality PVC pipes of Class 2 , conforming to IS 4985-2000, of 65mm dia for weep holes including encasing with using plain cement concrete 1:2:4 (1cement : 2 coarse sand : 4 graded stone aggregate 20mm nominal size) ,filling loose gravels at the mouth opening towards the filled up soil etc., complete all as shown in the drawing and as directed	Rmt	500		
	SWD - 8	Providing and laying NP-2 class RCC Hume Pipes with collars jointed with stiff mixture of cement mortar 1:2 (1 cement : 2 fine sand) including testing of joints, including necessary excavation in foundations upto a depth of maximum 1.5m for laying pipes and laying PCC (1:3:6) near the pipe joints of size 300x300x100mm and refilling the excavated soil in the trench etc., complete all as directed				
		a) 600mm dia	Rmt	50		
		b) 900mm dia	Rmt	50		
		Note: Quantities mentioned are approximat only and are likely to get increased or decreased based on actual requirements while execution of the jobs.				

Amount in Rs.

Amount in Lakhs.

PAITHAN MEGA FOOD PARK PVT. LTD.
AT PAITHAN (MH)

BOOK No. 2

Bill of Quantities (BoQ)

BID NO. PMFPPL – SWD – 01 – 2016



Paithan Mega Food Park Pvt. Ltd.

Nath House, Nath Road, Aurangabad-431005, Maharashtra

Project Management Consultants (PMC)

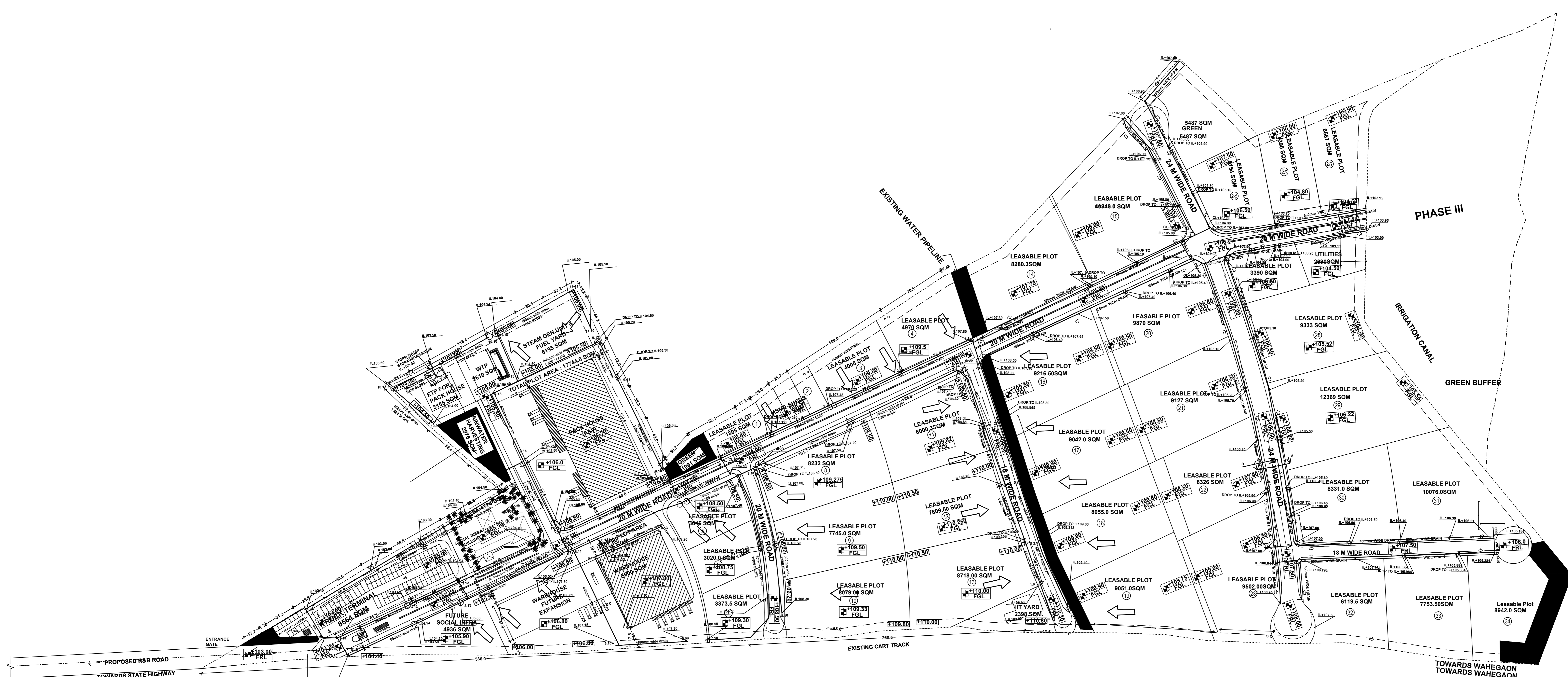


Abhyuday Techno Economic Consultants Pvt. Ltd.
211-212, Patel Avenue, Near Gurudwara
S.G. Highway, Thaltej, Ahmedabad – 380054, Gujarat

A/E Consultants



SEMAC Consultants Private Limited
'Conjeevaram House', 2nd Floor, 6-1-276,
Padmarao Nagar, Secunderabad – 500 025.



TENDER DRAWING

COMMENTS
1. ALL DIMENSIONS ARE IN MTS. & ARE TO BE READ NOT MEASURED.
2. DISCREPANCY FOUND IN DRG SHOULD BE BROUGHT TO THE NOTICE OF UNDERSIGNED IMMEDIATELY BEFORE COMMENCEMENT OF WORK.
3. ARCH. DWGS. TO HAVE PRECEDENCE OVER STRL. DWGS. FOR LVLS & DIMENSIONS.
4. LARGE SCALE DRGS TO HAVE PRECEDENCE OVER SMALL SCALE DRGS.
5. ALL DIMENSIONS ARE TO THE FINISHED SURFACE DIMENSIONS.
6. ALL LEVELS ARE TO THE FINISHED FLOOR LEVELS.
7. FINISHES THICKNESS TO BE DEDUCTED OR ADDED IF REQUIRED.
8. ± 0.00M. LV CONSIDERED AS SURROUNDING FRL.

KEY MAP

LEGEND

REFERENCE
S.NO. DRAWING NO.
1 FPA-AR-SP-101
2 FPA-RC-SWD-202

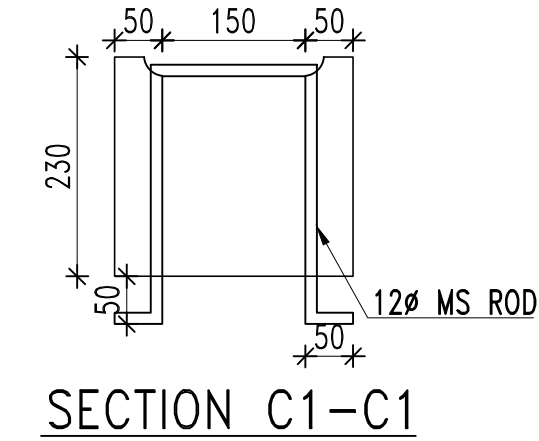
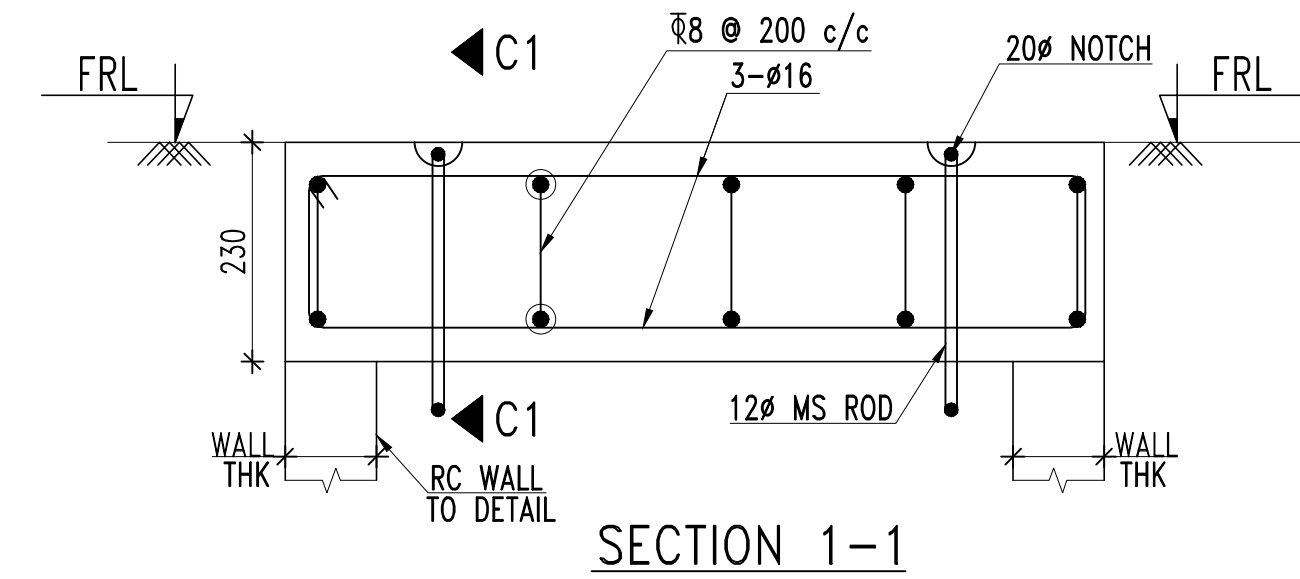
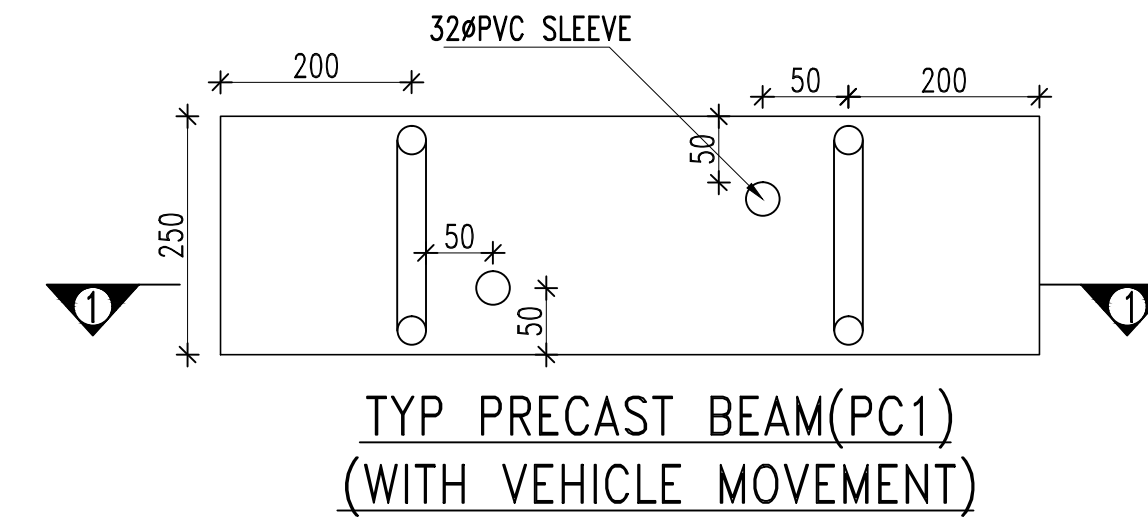
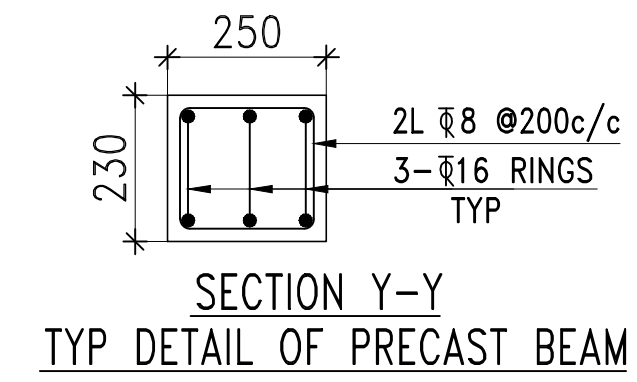
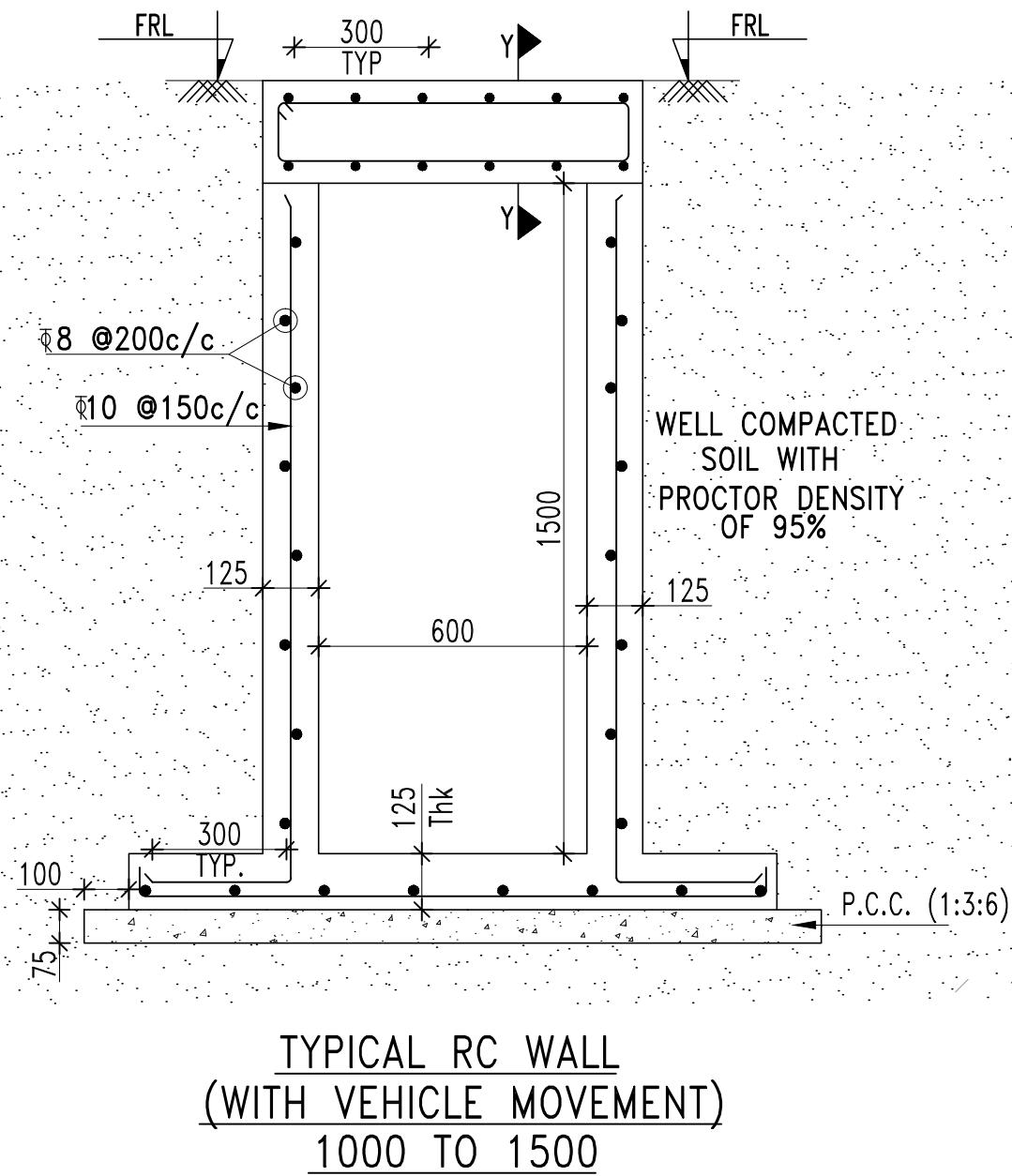
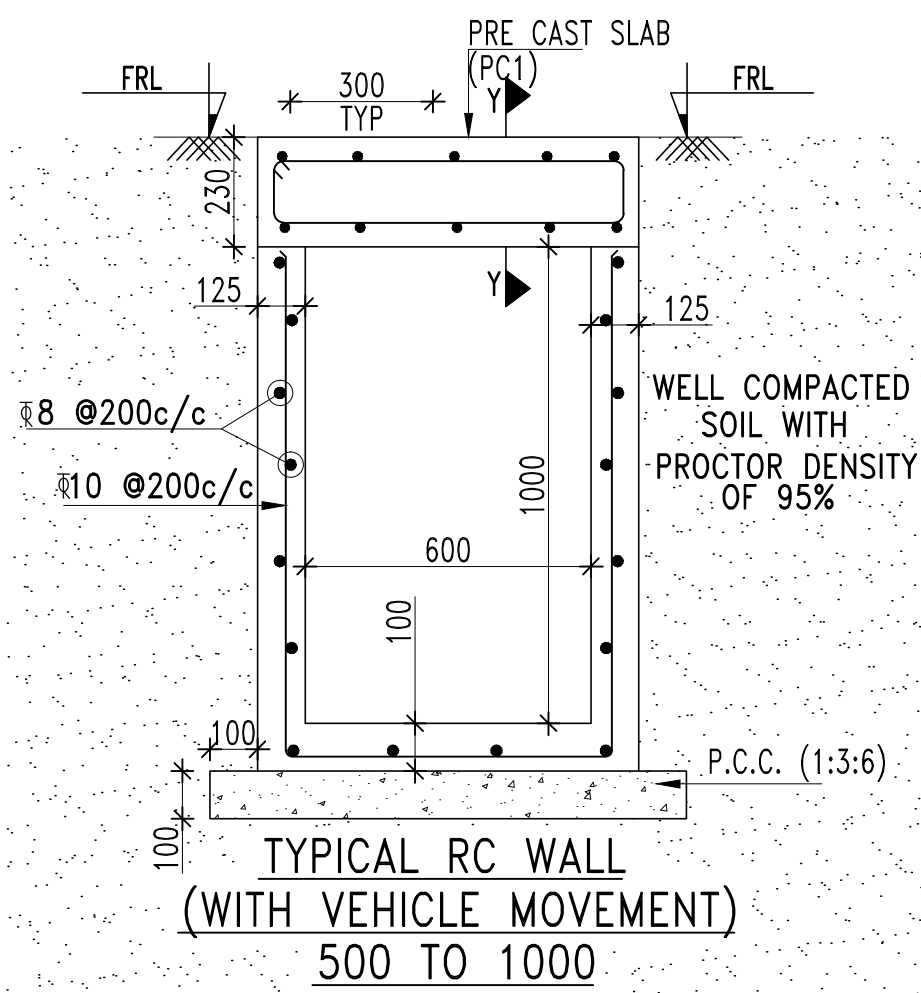
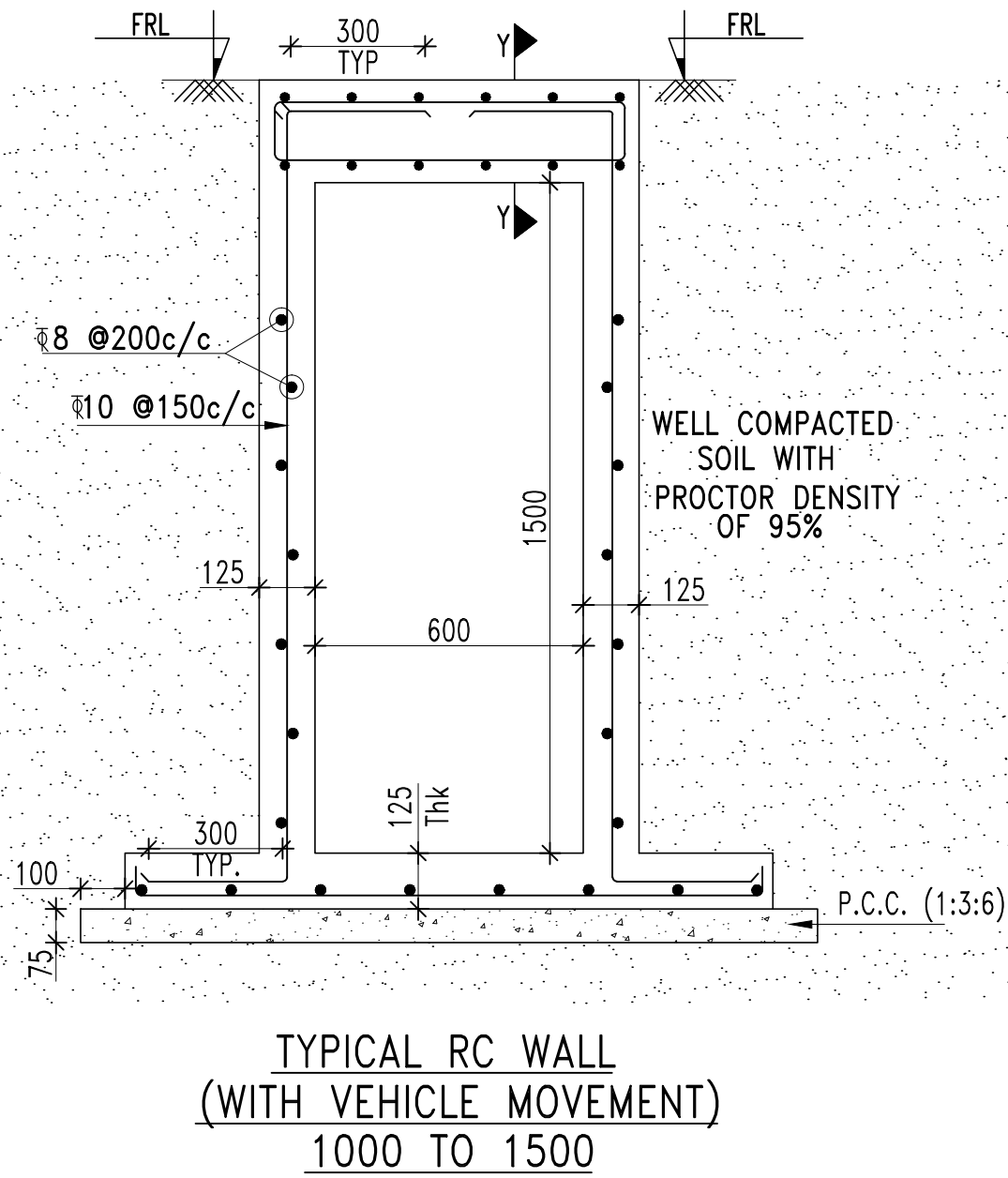
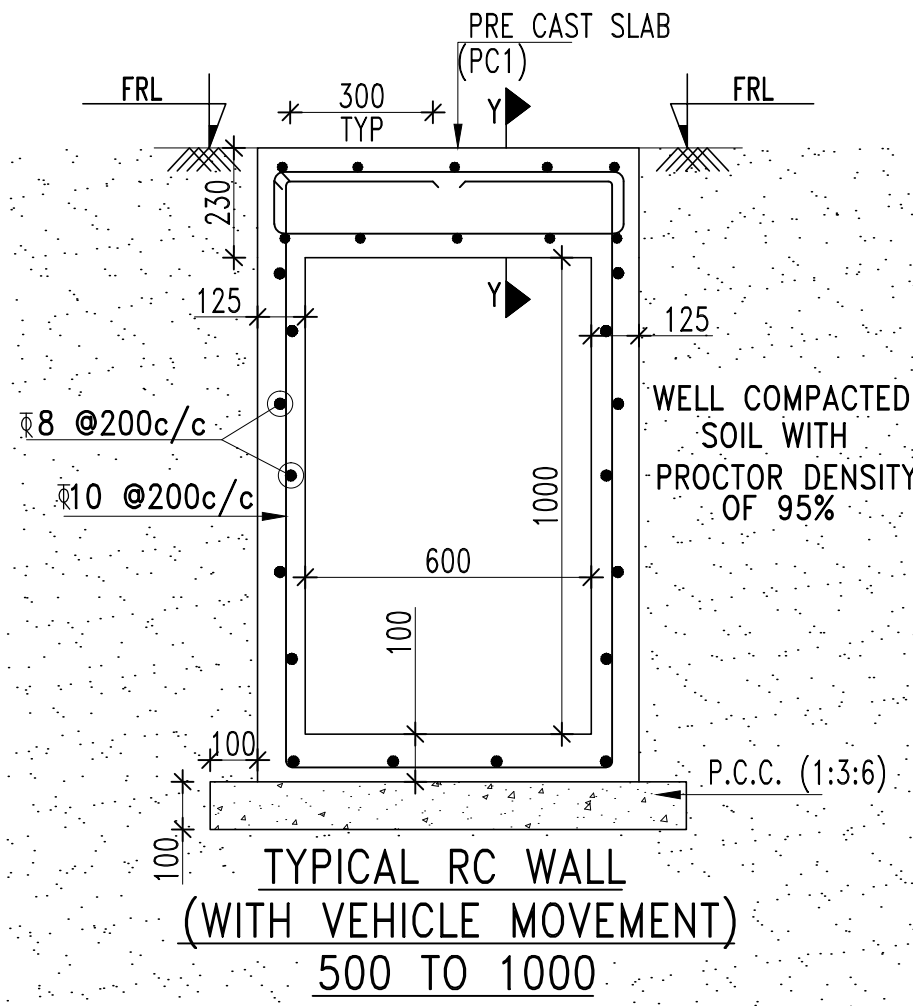
REVISIONS
REV. DESCRIPTION DATE DRWN CHKD
A TENDER 26/02/2015 GANESH CKS

FINISHING SCHEDULE

SCHEDULE OF OPENINGS			
TYPE DESCRIPTION SIZE QTY			
D1			
D2			
W1			
W2			
V			

PROJECT :	PAITHAN MEGAFOOD PARK PVT LTD
CLIENT :	PAITHAN MEGAFOOD PARK PVT LTD
PMC :	ABHYUDAY TECHNO ECONOMIC CONSULTANTS PVT LTD
A/E CONSULTANT :	SEMAM CONSULTANTS PVT LTD
CONJEEVARAM HOUSE, ARCHANA BLOCK, 2ND FLOOR, 6-1-276	
PADMARAO NAGAR, SECUNDERABAD - 500 025 (A.P.)	
TEL: 27508968, 27502088, FAX: 040-2750733	

TITLE :	PHASE-1&2
	STORM WATER LAYOUT
JOB NO :	H-10-11/013
SIZE :	RELEASED FOR
NAME SIGN DATE NORTH	
DSGN CKS 26/02/15	<input type="checkbox"/> PRILIMINARY
DRWN GANE 26/02/15	<input type="checkbox"/> APPROVAL
CHKD CKS 26/02/15	<input checked="" type="checkbox"/> TENDER
APPD CKS 26/02/15	<input type="checkbox"/> CONSTRUCTION
SCALE : 1:2000	<input type="checkbox"/> ASBLT
DRG NO : FPA-PH-SWD-608	REV 0



COMMENTS
1. ALL DIMENSIONS ARE IN MTS. & ARE TO BE READ NOT MEASURED.
2. DISCREPANCY FOUND IN DRG SHOULD BE BROUGHT TO THE NOTICE OF UNDERSIGNED IMMEDIATELY BEFORE COMMENCEMENT OF WORK.
3. ARCH. DWGS. TO HAVE PRECEDENCE OVER STR. DWGS. FOR LVLS & DIMENSIONS.
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7. FINISHES THICKNESS TO BE DEDUCTED OR ADDED IF REQUIRED.
8. ± 0.00M. LV CONSIDERED AS SURROUNDING FRL.

KEY MAP

S.NO	DRAWING NO.	REV.	DESCRIPTION	DATE	DRWN	CHKD
1	FPA-AR-SP-101	A	TENDER	26/02/2015	JYT	CKS
2	FPA-AR-RD-101					
2	FPA-PH-SD-608					

REV.	DESCRIPTION	DATE	DRWN	CHKD

TYPE	DESCRIPTION	SIZE	QTY

PROJECT :
PAITHAN MEGAFOOD PARK AT VILLAGE,
DHANGAON NO.53,55,56&62/2 WAHEGAON,
TQ,PAITHAN,DIST.AURANGABAD.

CLIENT :
PAITHAN MEGAFOOD PARK Pvt Ltd
C/o NATH SEEDS Pvt.Ltd,NATH RD,
PAITHAN AURANGABAD RD,
AURANGABAD.

PMC :
ABHYUDAY TECHNO ECONOMIC
CONSULTANTS Pvt. Ltd.
211-212, PATEL AVENUE,
NR. GURUDWARA,S.G.HIGHWAY, THALTEJ,
AHMEDABAD - 380054, GUJARAT, INDIA.
Phone: (0) +91 - 79 - 26856999, (M) +91 9714242226

A/E CONSULTANT :
SEMAM CONSULTANTS Pvt Ltd
CONJEEVARAM HOUSE,ARCHANA BLOCK,2ND FLOOR,
6-1-276PADMARAO NAGAR,SECUNDERABAD - 500 025 (A.P.)
TEL:27508968,27502088,FAX: 040-27507733

TITLE : RCC DRAIN SECTIONS			
JOB NO : H-11-12/013	SIZE :	RELEASED FOR	
NAME	SGN	DATE	NORTH
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DRWN	RD	26/02/15	<input type="checkbox"/> APPROVAL
CHKD	CKS	26/02/15	<input checked="" type="checkbox"/> TENDER
APPD	CKS	26/02/15	<input type="checkbox"/> CONSTRUCTION
SCALE -			<input type="checkbox"/> ASSULT
DRG NO : FPA-RCC-SD-202	REV		0

**PAITHAN MEGA FOOD PARK PVT. LTD.
AT PAITHAN (MH)**

BOOK NO. 4

TECHNICAL SPECIFICATION

BID NO. PMFPPL – SWD – 01 – 2016



Paithan Mega Food Park Pvt. Ltd.

Nath House, Nath Road, Aurangabad-431005, Maharashtra

Project Management Consultants (PMC)



Abhyuday Techno Economic Consultants Pvt. Ltd.

211-212, Patel Avenue, Near Gurudwara
S.G. Highway, Thaltej, Ahmedabad – 380054, Gujarat

A/E Consultants



SEMAC Consultants Private Limited

'Conjeevaram House', 2nd Floor, 6-1-276,
Padmarao Nagar, Secunderabad – 500 025.

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12.	FENCING WORK WITH BARBED WIRE, CHAIN LINK ETC.,	106

1. GENERAL

The detailed specifications given hereinafter are for the items of works described in the schedule of quantities attached herein, and shall be guidance for proper execution of work to the required standards. It may also be noted that the specifications are of generalized nature and these shall be read in conjunction with the description of item in schedule of quantities and drawings. The work also includes all minor details of construction which are obviously and fairly intended and which may not have been referred to in these documents but are essential for the entire occupation in accordance with standard Engineering practice.

Unless specifically otherwise mentioned, all the applicable codes and standards published by the Indian Standard Institution and all other standards which may be published by them before the date of receipt of tenders, shall govern in all respects of design, workmanship, quality and properties of materials and methods of testing, methods of measurements etc. Wherever any reference to any Indian Standard Specifications occurs in the documents relating to this contract, the same shall be inclusive of all amendments issued thereto or revision thereof, if any, up to the date of receipt of tenders.

Wherever any reference to any Indian Standard Specification 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 tenders. In case there is no I.S.I. specification for the particular work, such work shall be carried out in accordance with the instructions in all respects, and requirements of the Engineer-in-Charge. The work shall be carried out in a manner complying in all respects with the requirements of relevant bye-laws of the Municipal Committee/Municipal Corporation/Development Authority / Improvement Trust under the jurisdiction of which the work is to be executed or as directed by the Engineer-in-Charge and, unless otherwise mentioned, nothing extra shall be paid on this account.

Samples of various materials, fittings, etc. proposed to be incorporated in the work shall be submitted by the contractor for approval of the Engineer-in-charge before order for bulk supply is placed.

The contractor shall take instructions from the Engineer-in-charge regarding collection and stacking of materials in any place. No excavated earth or building materials shall be stacked on areas where buildings, roads, services, compound walls etc. are to be constructed.

The contractor shall maintain in perfect condition all works executed till the completion of the entire work allotted to him. Where phased delivery is contemplated, this provision shall apply to each phase.

The contractor shall give a performance test of the entire installation(s) as per standard specifications before the work is finally accepted and nothing extra whatsoever shall be payable to the contractor for the test.

The contractor shall clear the site thoroughly of all scaffolding materials and rubbish etc. left out of his work and dress the site around the building to the satisfaction of the Engineer-in-charge before the work is considered as complete.

2. LIST OF INDIAN STANDARDS:

Following are the various Indian Standards, relevant to the Civil Engineering work :

(Latest Revision to be referred.)

No.	Indian Standard	Subject
1	Carriage of materials	
	4082-1996	Stacking & storage of construction materials and components at site - Recommendations
2	Earth Work :	
	1200 Pt.I-1992	Method of measurement of Earth work
	4081-1986	Safety code for Blasting and related drilling Operations.
	6313(pt.II)-2001	Anti-termite measures in buildings (Pt.II-Pre-constructural chemical treatment)
3	Mortar :	
	269-1989	Specification for 33 Grade Ordinary Portland cement
	383-1970	Specification for Coarse and fine aggregates from natural sources for Concrete
	455-1989	Specification for Portland slag cement
	650-1991	Standard sand for testing of cement
	712-1984	Building Lines
	1269	Specification for 53 Grade Ordinary Portland cement
	1344-1981	Specification for calcined clay pozzolana
	1489-1991 (Part-I-II)	Portland Pozzolana cement
	1514-1990	Methods of sampling & Test for quick lime and Hydrated lime
	1542-1992	Sand for plastering
	1727-1967	Methods of tests for pozzolanic materials
	2250-1981	Code of practice for preparation and use of masonry Mortar
	2386-1977	Methods of test for aggregates for concrete
	2386 pt. I-1977	Particle size and shape
	2386 Pt.II_1977	Estimation of deleterious materials and organic impurities
	2386 pt. III-1977	Specific gravity, density, voids, absorption and bulking
	2686-1977	Cinder as fine aggregate for use of lime concrete
	3025-1987	Methods of sampling and test (physical and chemical) water used in industry
	3068-1986	Broken brick (burnt clay) coarse aggregate for use in lime concrete (II-R)
	3182-1986	Broken brick(burnt clay) fine aggregate for use in lime mortar
	3812-1987	Fly ash
	3812pt.I 2003	Fly ash for use as pozzolana
	3812pt.II 2003	Fly ash for use as admixture for concrete
	3812pt III 2003	Fly ash for use as fine aggregate for mortar and concrete
	4031-1996	Methods of physical tests for hydraulic cement
	4032-1985	Method of chemical analysis of hydraulic cement
	4098-1983	Lime pozzolana mixture

No.	Indian Standard	Subject
	6932(pt.I to X)	Methods of test for building lime
	6932 (pt.I)- 1973	Determination of insoluble residue, loss of ignition, insoluble matter, silicon-dioxide, ferric and aluminum oxide, calcium oxide and magnesium oxide.
	6932 (pt.II)- 1973	Determination of carbon dioxide content
	6932(pt.III)- 1973	Determination of residue on slaking of quick lime
	6932 (pt.IV) - 1973	Determination of fineness of hydrated lime
	6932 (ptV)-1973	Determination of unhydrated oxide
	6932(pt.VI)- 1973	Determination of volume yield of quick lime
	6932 (ptVII)- 1973	Determination of compressive and transverse strength
	6932(pt.VIII)- 1973	Determination of workability
	6932 (pt.IX)- 1973	Determination of soundness
	6932(pt.X)-1973	Determination of popping and pitting of hydrated lime
4	Concrete work;	
	383-1970	Coarse and fine aggregates from natural sources for Concrete
	456-2000	Code of practice for plain and reinforced concrete
	515-1959	Specifications for natural and manufactured aggregate for use in mass concrete
	516-1959	Method of test for strength of concrete
	1198-1959	Method of sampling and analysis of concrete
	1200(pt.II)- 1985	Methods of measurements of cement concrete work
	1322-1993	Bitumen felts for water proofing and damp proofing
	1661- 1987(pt.III)	Code of practice for application of cement lime plaster finishes
	2386-1977	Methods of test for aggregate for concrete
	2386(pt.I)-1977	Test for particle size and shape
	2386(pt.II)- 1977	Test for estimation of deleterious materials and organic impurities.
	2386(pt.III)- 1977	Test for specific gravity, density. voids, absorption and bulking
	2386(pt.IV)- 1977	Mechanical properties
	2645-1975	Specification for integral water proofing compounds
	2686-1977	Specification for cinder aggregate for use in lime concrete
	3812-1981	Fly ash
	3812(pt.I)	Fly ash for use as pozzolana for concrete
	3812(pt.II)	Fly ash for use as admixture for concrete
	3812(pt.III)	Fly ash for use as fine aggregate for mortar and concrete
	7861- 1975(pt.I)	Hot weather concreting
	7861- 1981(pt.II)	Cold weather concreting

No.	Indian Standard	Subject
	9103-1999	Admixture for concrete
5	RCC Work:	
	432-1982	Mild steel and medium tensile steel bars and hard drawn steel wire for concrete reinforcement
	432(pt.I)-1982	Mild steel and medium tensile steel bars
	456-2000	Code of practice for plain and reinforced concrete
	457-1957	Code of practice for general construction of plain an reinforced concrete for dams and other massive structure
	516-1959	Methods of test for strength of concrete
	1139-1966	Hot rolled mild steel, medium tensile steel and high yield strength steel deformed bars for concrete reinforcement
	1199-1959	Methods of sampling ad analysis of concrete
	1200(pt.II)-1974	Methods of measurement of cement concrete work
	1200(pt.V)-1982	Method of measurement of form work
	1343-1980	Code of practice for priestesses concrete
	1566-1985	Hard drawn steel wire fabric for concrete reinforcements
	1780-1961	Specifications for cold twisted steel bars for concrete reinforcement
	1785-1983 (pt.I&II)	Specifications for plain hard draw steel wire for pre-stressed concrete
	1786-1985	Cold twisted steel bars for concrete reinforcement
	2080-1980	Specifications for high tensile steel bars used in pre-stressed concrete
	2204-1962	Code of practice for construction of reinforced concrete shell roof
	2210-1988	Criteria for the design of steel structure and folded plates.
	2502-1963	Code of practice for bending and fixing of bars for concrete reinforcement
	2751-1979	Code of practice for welding of mild steel bars used for reinforced cement construction
	2911-1979	Code of practice for design and construction of pile Foundations
	2911(pt.I)-1979	Load bearing concrete piles
	2911(pt.III)-1980	Under reamed pile foundations
	3201-1988	Criteria for design and construction of precise concrete trusses
	3370(part I to IV)-1965	Code of practice for concrete structures for storage of liquids
	3385-1986 (is1200,pt23:1988)	Code of practice for measurement for Civil Engineering works.
	3414-1968	Code of practice for design and installation of joints in buildings
	3588-1987	Code of practice for use of immersion vibrators for consolidating concrete
	3935-1966	Code of practice for composite construction
	4014-1967(pt.I &II)	Code of practice for steel tubular scaffolding (I: Definition / Material: II: Safety Regulations)
	4990-1993	Specifications for plywood for concrete shuttering work
	10262 -1982	Code of practice for design mix

No.	Indian Standard	Subject
6	Equipments :	
	460-1985 (pt1,2,3)	Specification for test sieves
	1791-1985	Specification for batch type concrete missed
	2430-1986	Specification for roller pan mixer
	2585-1968	Specification for concrete vibrators, immersion type
	2806-1964	Specification for screen board concrete vibrators
	2514-1963	Specification for concrete vibrating tables
	3366-1965 (with drawn)	Specification for pan vibrators
	4656-1968	Specification for form vibrators for concrete
	2722-1964	Specification for portable swing weight batchers for concrete (single and double bucket type)
	2750-1964	Specification for steel scaffolding.
7	Stone Work:	
	1121-(pt.I)-1974	Methods for determination of compressive, transverse and shear strengths of natural building stones
	1122-1974	Methods for determination of specific gravity and porosity of natural building stones
	1123-1975	Methods of test for water absorption of natural building stones
	1124-1974	Methods of test for absorption of natural building stones
	1125-1974	Methods of test for weathering of natural building stones
	1126-1974	Methods of test for durability of natural building stones.
	1129-1972	Dressing of natural building stones
	1200(pt.IV)-1976	Method of measurement of stone masonry
	1597-1967	Code of practice for construction of rubble stone masonry
	1597(pt.I)-1992	Code of practice for construction of masonry
	1597(pt.II)-1992	Code of practice for construction of Ashlar masonry
	1805-1973	Glossary of items relating to stone quarrying and Dressing
	4101(pt.I)-967	Stone facing
8	Steel Work:	
	63-1978	Whiting for paints
	198-1978	Varnish, gold size
	226-1975	Structural steel (standard quality)
	277-1985	Specification for galvanized steel sheets (plain and corrugated)
	278-1978	Galvanized steel barbed wire for fencing
	800-1984	Code of practice for use of structural steel in General building construction
	806-1968	Code of practice for use of steel tube in general building construction
	813-1986	Scheme of symbols for welding
	814-1991	Covered electrodes for metal are welding of structural steel.
	814(pt.I)-1974	For welding products other than sheets
	814(pt.II)-1974	For welding sheets
	815-1974	Classification and coding of covered electrodes for metal are welding of mild steel and low alloy high tensile steel

No.	Indian Standard	Subject
	817-1966	Code of practice for training and testing of metal are welders
	818-1968	Code of practice for safety and healthy requirements in electric and gas welding and cutting operation
	1038-1983	Steel doors, windows and ventilators
	1081-1960	Code of practice for fixing and glazing of metal (steel and aluminum) door, windows and ventilators)
	1148-1982	Hot rolled steel river bars (up to 40mm diameters) for structural purposes
	1161-1979	Steel tubes for structural purposes
	1182-1983	Recommended practice for radiographic examination of fusion welded joints in steel plates
	1200-1974	Method of measurements of steel work and iron works
	1363-1984	Hexagon bolts, nuts and lock nuts (dia 6 to 39mm) and black hexagon screws (dia 6 to 24 mm)
	1599-1985	Method for bend test for steel products other than sheet, strip, wire and tube
	1608-1972	Method for tensile testing of steel products
	1821-1987	Dimensions for clearance holes for metric bolts
	1852-1985	Rolling and cutting tolerance for hot rolled steel products
	1894-1972	Method for tensile testing of steel tubes
	1977-1975	Structural steel (ordinary quality)
	2062-1984	Structural steel (fusion welding quality)
	4351-1976	Steel door frames
	4736-1986	Hot-dip zinc coatings on steel tubes
	6248-1979	Metal rolling shutters and rolling grills
	7452-1990	Hot rolled steel sections for doors, windows & ventilations
9	Safety Codes:	
	3764-1966	Safety code for Excavation works
	7293-1974	Working with construction machinery safety code.

3. CARRIAGE OF MATERIALS

General

The carriage and stacking of materials shall be done as directed by the Engineer – in – charge. Any tools and plants, required for the work shall be arranged by the Contractor. The Carriage of materials includes loading within a lead of 50 metres, unloading and stacking within lead of 50 metres.

Responsibility for Loss or Damage

Loading, carriage, unloading and stacking shall be done carefully to avoid loss or damage to the materials. In case of any loss or damage, recovery shall be effected from the Contractor at twice the Departmental issue rates of the materials. If the departmental issue rates of the materials are not available then the recovery shall be effected at twice the prevailing market rates as determined by the Engineer-in-Charge.

Mode of carriage

Depending upon the feasibility and economy, the Engineer-in-Charge shall determine the mode of carriage viz. whether by mechanical or animal transport or manual labour.

Lead

All distances shall be measured over the shortest practical route and not necessarily the route actually taken. Route other than shortest practical route may be considered in cases of unavoidable circumstances and as approved by Engineer-in-Charge along with reasons in writing.

Carriage by manual labour shall be reckoned in units of 50 metres or part thereof. Carriage by animal and mechanical transport shall be reckoned in one km unit. Distances of 0.5km or more shall be taken as 1 km and distance of less than 0.5 km shall be ignored. However, when the total lead is less than 0.5 km, it will not be ignored but paid for separately in successive stages of 50metres subject to the condition that the rate worked on this basis does not exceed the rate for initial lead of 1 km by mechanical/ animal transport.

General Consideration for Stacking and Storage

Planning of Storage Layout

For any site, there should be proper planning of the layout for stacking and storage of different materials, components and equipments with proper access and proper manoeuvrability of the vehicles carrying the material. While planning the layout, the requirements of various materials, components and equipments at different stages of construction shall be considered.

Material shall be stored in such a manner as to prevent deterioration or intrusion of foreign matter and to ensure the preservation of their quality and fitness for the work.

Protection against Atmospheric Agencies

Materials stored at site, depending upon the individual characteristics, shall be protected from atmospheric actions, such as rain, sun, winds and moisture to avoid deterioration.

Protection against Fire and other Hazards

Materials like timber, coal, paints, etc. shall be stored in such a way that there may not be any possibility of fire hazards. Inflammable materials like kerosene and petrol, shall be stored in accordance with the relevant rules and regulations so as to ensure the desired safety during storage. Stacks shall not be piled so high as to make them unstable under fire fighting conditions and in general they shall not be more than 4.5m in height. The provisions given in IS 13416 (part 5) shall be followed.

Stacking and Storage of Materials

Cement :

In case cement is received in bags. Cement shall be stored at the work site in a building or a shed which is dry, leakproof and as moisture proof as possible. The building or shed for storage should have minimum number of windows and close fitting doors and these should be kept closed as far as possible.

Cement shall be stored and stacked in bags and shall be kept free from the possibility of any dampness or moisture coming in contact with them. Cement bags shall be stacked off the floor on wooden planks in such a way as to keep about 150 mm to 200 mm clear above the floor. The floor may comprise of lean cement concrete or two layers of dry bricks laid on well consolidated earth. A space of 600 mm minimum shall be left around between the exterior walls and the stacks.

In the stacks the cement bags shall be kept close together to reduce circulation of air as much as possible. Owing to pressure on the bottom layer of bags sometimes warehouse pack' is developed in these bags. This can be removed easily by rolling the bags when the cement is taken out for use. Lumbered bags, if any should be removed and disposed off.

The height of stack shall not be more than 10 bags to prevent the possibility of lumping up under pressure. The width of the stack shall be not more than four bags length or 3 metres. In stacks more than 8 bags high, the cement bags shall be arranged alternately length-wise and cross-wise so as to tie the stacks together and minimize the danger of tipping over. Cement bags shall be stacked in a manner to facilitate their removal and use in the order in which they are received; a label showing date of receipt of cement shall be put on each stack to know the age of cement.

For extra safety during the monsoon, or when it is expected to store for an unusually long period, the stack shall be completely enclosed by a water proofing membrane such as polyethylene, which shall close on the top of the stack. Care shall be taken to see that the waterproofing membrane is not damaged any time during use.

Cement in gunny bags, paper bags and polyethylene bags shall be stored separately,

In case cement is received in drums

These shall be stored on plane level ground, as far as possible near the concrete mixing place. After taking out the required quantity of cement, the lid of the drum shall be securely tied to prevent ingress of moisture.

In case cement is received in silos

The silos shall be placed near the concrete batching plant. Proper access shall be provided for the replacement of silos.

Different types of cements shall be stacked and stored separately

Aggregates:

Aggregates shall be stored at site on a hard dry and level patch of ground. If such a surface is not available, a platform of planks or old corrugated iron sheets, or a floor of bricks, or a thin layer of lean concrete shall be made so as to prevent contamination with clay, dust, vegetable and other foreign matter.

Stacks of fine and coarse aggregates shall be kept in separate stock piles sufficiently removed from each other to prevent the material at the edges of the piles from getting intermixed, On a large job, it is desirable to construct dividing walls to give each type of aggregates its own compartment. Fine aggregates shall be stacked in a place where loss due to the effect of wind is minimum.

Unless specified otherwise or necessitated by site conditions stacking of the aggregates should be earned out in regular stacks. The suggested sizes for stacks are as follows

SI. no.	Material	Size of Stack (in m)		
		Length	Breadth	Height
(i)	Soling stone	5.0	2.0	0.50
		Or 5.0	1.0	0.50
(ii)	Coarse aggregates	2.0	2.0	0.50
		Or 5.0	5.0	1.00
		Or 5.0	1.0	0.50
(iii)	Fine aggregates	2.0	2.0	0.50
		Or 5.0	5.0	1.00
		Or 5.0	1.0	0.50

Fly ash:

Fly ash shall be stored in such a manner as to permit easy access for proper inspection and identification of each consignment. Fly ash in bulk quantities shall be stored in stack similar to fine aggregates as specified above to avoid any intrusion of foreign matter. Fly ash in bags shall be stored in stacks not more than 10 bags high

Steel:

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

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.

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.

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

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.

Water :

Wherever water is to be stored for construction purposes this shall be done in proper storage tanks to prevent any organic impurities getting mixed up with it

Other Materials :

Small articles like nails, screws, nuts and bolts, door and window fittings, polishing stones, protective clothing, spare parts of machinery, linings, packing, water supply and sanitary fittings, electrical fittings, insulation board, etc, shall be kept in suitable and properly protected store rooms. Valuable small material such as, copper pipes and fittings shall be kept under lock and key.

Measurements :

Length, breadth and height of stacks shall be measured correct to a cm. The quantity shall be worked out in cubic metre correct to two place of decimal. The volume of stacks shall be reduced by percentages as shown against each for looseness in stacking to arrive at the net quantity for payment No reduction shall be made in respect of articles or materials for which mode of payment is by length or weight or number.

Earth :

In loose stacks such as cart loads, lorry loads, etc. - 20%

In fills consolidated by light mechanical machinery - 10%

In fills consolidated by heavy mechanical machinery but not under OMC (Optimum Moisture Content) - 5%

In fills consolidated by heavy mechanical machinery at OMC - Nil

Consolidated fills in confined situation such as under floors, etc - Nil

Other Materials :

Manure or sludge - 5%

Moorum, building rubbish Lime and sand - Nil

Stone metal, 40 mm nominal size and above - 7.5%

Coarse aggregate/ stone metal below 40 mm nominal size - Nil

Soling stone/ Boulder 100 mm and above -15%

Excavated rocks - 50%

Rate :

The rate for carriage of materials is inclusive of all the operations described above.

4. EXCAVATIONS FILL AND BACKFILL

Scope of Work

The scope for work covered under this specifications pertain to excavation of foundations, trenches, pits and over areas, in all sorts of soil, soft and hard rock, correct to dimensions given in the drawing including shoring, protections of existing underground utilities of any, such as water lines, electric cables etc. dewatering and shoring if necessary, stacking the useful materials as directed within the lead specified, refilling around the foundation and into the plinth with selected useful excavated earth and disposing off the surplus earth / materials within specified lead and finishing the surface to proper levels, slopes and camber etc. all complete.

Site Clearance:

Before the earth work is started, the area coming under cutting and filling shall be cleared of all obstruction, loose stones, shrubs, rank vegetation, grass, bushes and rubbish removed up to a distance of 50 meters outside the periphery of the area under clearance. The roots of trees if any shall be removed to a minimum depth of 60 cm below ground level or a minimum of 30 cm below formation level or 15 cm below formation level , whichever is lower and the hollows filled up with earth leveled and rammed. This work is deemed to be included in the earthwork items and no separate payment will be admissible for the work.

Any material obtained from the site will be the property of the owner and the useful materials as decided by the Engineer-in-charge will be conveyed and properly stacked as directed within the lead specified.

Setting out and making profiles:

Masonry or concrete pillars will be erected at suitable points in the area to serve as benchmarks for the execution of the work. These benchmarks shall be connected with the standard bench mark or any other permanent benchmark approved by the Engineer-in-charge. Necessary profiles with pegs, bamboos and strings or Burjis shall be made to show the correct formation levels before the work is started. The contractor shall supply labour and materials for setting out and making profiles and Burjis for the work at his own cost and the same shall be maintained during the excavation work. The Engineer-in-charge will show grid co-ordinate or other reference points. It shall be the responsibility of the contractor to set out center lines correctly with reference to the drawings and install substantial reference marks. Checking of such alignment by the Engineer – in -charge will not absolve the contractor from his responsibility to execute the work strictly in accordance with the drawings.

Excavation:

The contractor shall notify the Engineer-in-charge before starting excavation and before the ground is disturbed, to enable him to take existing level for the purpose of measurements. The ground levels shall be taken at 5 to 15 meters intervals in uniformly sloping ground and at closer distance where local mounts pits, or undulations are met with, as directed by the Engineer-in-charge. The ground levels shall be recorded in field books and plotted on plans, which shall be signed by the Contractor and the Engineer-in-charge, before the earthwork is actually started. The labour required for taking levels, shall be supplied by the Contractor at his own cost. The Contractor shall perform excavation in all types of soils, morrum, soft and hard rock, boulders etc. in foundation, over areas and in trenches to widths, lines, levels, grades and curves as shown in the drawing or lesser widths, lines, levels, grades and levels as directed by the Engineer-in-charge and per items in the schedule of quantities.

The item in the schedule of quantities shall specify the excavation in trenches or over areas. For this purpose, the excavation for any depth in trenches for foundation not exceeding 1.5m in width or 10sqm. on plan shall be described as excavation in foundation trenches.

Excavation exceeding 1.5m in width as well as 10sqm. on plan (excluding trenches for pipes, cables etc.) and exceeding 30cm in depth shall be described as excavation over areas. Excavation exceeding 1.5m in width as well as 10sqm. on plan but not exceeding 30cm. in depth shall be described as surface Excavation.

Classification of Earth work :

The earthwork shall be classified under the following main categories and measured separately for each category.

All types of soil, morrum, boulders, Soft rock, Hard rock

All types of Soils, Morrum, Boulders:

This includes earth, morrum, top deposits of agricultural soil, reclaimed soil, clay, sand or any combination thereof and soft and hard morrum, shingle etc. which is loose enough to be removed with spadies, shovel and pick axes. Boulders not more than 0.03 cum. in volume found during the course of excavation shall also fall under this classification.

Excavation in Soft Rock :

This shall include all materials which are rock or hard conglomerate, all decomposed weathered rock, highly fissured rock, old masonry, boulders bigger than 0.03 cum, in volume but not bigger than 0.5 cum. and other varieties of soft rock which can be removed only with pick axes, crow bars, wedges and hammers with some difficulty. The mere fact that the contractor resorts to blasting and / or wedging and chiseling of reasons of his own, shall not mean the rock is classifiable as hard rock.

Excavation in Hard Rock :

This includes all rock other than soft rock, occurring in masses, boulders having approximate volume more than 0.5 cum. plain or reinforced cement concrete, which can best be removed by chiseling and wedging where blasting cannot be permitted owing to any restriction at site.

Excavation In Hard Rock by Chiseling and Wedging :

Where blasting is not permitted and if the Engineer-in-charge so desires, the excavation shall be done by chiseling and wedging or any other agreed method.

Note : All the excavated hard rock obtained shall be stacked properly and neatly within the specified lead by the contractor as directed by the Engineer-in-charge.

Excavation:

The excavation under all classifications in areas in trenches or in pits shall be carried out systematically. Cutting shall be done from top to bottom and not under pinning or under cutting will be allowed. The bottom and sides of excavation shall be dressed to proper level, slopes, steps, camber etc. by removing high spots and ramming thoroughly as directed by the Engineer-in-charge.

All the excavation shall be carried out strictly to the dimensions given in the drawing. The width shall generally be of the width of mudmat concrete and depth as shown in drawing or

as directed by the Engineer-in-charge, according to availability of the desired bearing capacity of soil below. Any excavation if taken below the specified depths and levels, the contractor shall at his own cost fill up such over cut to the specified level with cement concrete 1:4:8 in case of excavation in all types of soils and with cement concrete 1:2:4 in case of excavation soft and hard rock.

After the excavation is completed, the contractor shall notify the Engineer-in-charge to that effect and no further work shall be taken up until the Engineer-in-charge has approved the depth and dimensions and also the nature of foundation materials, levels and measurements shall also be recorded prior to taking up any further work.

Shoring :

Unless separately provided for in the schedule of quantities, the quoted rate for excavation shall include excavation of slopes to prevent falling in soil by providing and / or fixing, maintaining and removing of shoring, bracing etc. The contractor would be responsible for the design of shoring for proper retaining of sides of trenches, pits etc. with due consideration to the traffic, superimposed loads etc. shoring shall be of sufficient strength to resist the pressure and ensure safety from slips and to prevent damage to work and property and injury to persons. It shall be removed as directed after items for which it is required are completed should the slips occur, the slipped materials shall be removed and slope dressed to a modified stable slope. Removal of the slipped earth will not be measured for payment.

Blasting:

No blasting shall be carried out for excavation of foundation even in rocky formation, unless permitted by the Employer/PMC and subject to proper licenses and permission being obtained from the govt authorities concerned by the contractor.

Water logging :

The site shall be free from stagnation of water. Where directed by the Engineer the Contractor shall carry out minor earthworks to top up low-lying area or excavate drain to prevent stagnation of water. Earth for the filling shall be cut from site as indicated on the drawings or from the Contractor's own source as indicated and directed.

Discarded well :

The Contractor shall locate all discarded wells and pits and fill them. Illegally dumped earth or the like which do not contain debris or undesirable materials as determined by the Engineer may be used to fill up all such wells and pits with sufficient material heaped over them to allow for settlement

Dewatering :

Unless specifically provided for as a separate item in the schedule of quantities, rate shall also include bailing or pumping out all water which may accumulate in the excavation during the progress of further works such as mud mat concrete, R.C. footings, shuttering etc. either due to seepage, springs, rain or any other cause and diverting surface flow by bunds or other means. Care shall be taken to ensure that the water discharged sufficiently away from the foundations to keep it free from nuisance to other works in the neighborhood.

The bunds shall be removed after their purpose is served. Pumping out water from any foundation enclosure or trenches shall be done generally in such a manner as to preclude the possibility of any damage to the foundation trenches, concrete or masonry or any adjacent structure. The excavation shall be kept free from water:

- a. during inspection and measurement.
- b. When placing of concrete or masonry is in progress and until they have come above the natural water level.
- c. Till the PMC/Employer considers that the concrete or mortars have set and hardened sufficiently.
- d. During back filling and consolidating.

Disposal of Excavated Materials :

Antiquities :

Any finds of archeological interest such as relics of antiquity, coins, fossils or other articles of value shall be delivered to the Engineer-in-charge and shall be the property of the Owner.

Useful Materials :

Any material obtained from the excavation which in the opinion of the Engineer-in-charge is useful, shall be stacked separately in regular stacks as directed by the Engineer-in-charge and shall be the property of the Owner.

No material excavated from foundation trenches of whatever kind they may be are to be placed even temporarily nearer than about 3m from the outer edge of excavation. Discretion of the Engineer-in-charge in such cases is final. All materials excavated will remain the property of the Owner. Rate for excavation includes sorting out of the useful materials and stacking them separately as directed within the specific lead. -Material suitable and useful for backfilling or there use shall be stacked in convenient place but not in such a way as to obstruct free movement of materials, workers and vehicles or encroach on the area required for constructional purposes. It shall be used to the extent required to completely backfill the structure to original ground level or other elevation shown on the plan or as directed by the Engineer-in-charge. Materials not useful in anyway shall be disposed off, leveled and compacted as directed by the Engineer-in-charge within a specified lead. The site shall be left clean of all debris and levelled on completion.

Backfilling in sides of Foundations, Plinth, Under Floor etc:

The backfilling shall be done after the concrete or masonry has fully set and shall be done in such a way as not to cause under-thrust on any part of the structure. Where suitable excavated material is to be used for backfilling, it shall be brought from the place where it was temporarily deposited and shall be used in backfilling. The scope of work for backfilling/ filling in foundation, plinth, under floors etc. shall include filling for all the buildings covered under the contract. Surplus earth available from one building, if required, shall be used for backfilling / filling for other buildings also within the specified lead mentioned in the item.

All timber shoring and form work left in the trenches, pits, floors etc. shall be removed after their necessity ceases and trash of any sort shall be cleared out from the excavation. All the space between foundation masonry or concrete and the sides of excavation shall be backfilled to the original surface with approved materials in layers not exceeding 150mm, in thickness, watered and well consolidated by means of rammers to at least 90% of the consolidation will not be allowed. Areas inaccessible to mechanical equipment such as areas adjacent to walls and columns etc. shall be tamped by hand rammer or by hand held power rammers to the required density. The backfill shall be uniform in character and free from large lumps, stones, shingle or boulder not larger than 75mm. in any direction, salt, clods, organic or other foreign materials which might rot. The backfilling in plinth and under floor shall be well consolidated by means of mechanical or hand operated rammers as specified to achieve the required density.

Test to establish proper consolidation as required will be carried out by the Engineer at rates specified. The cost of tests carried out will be well consolidated by means of mechanical or hand operated rammers as specified to achieve the required density.

Filling in Plinth and Under Floors :

After the available suitable excavated materials are exhausted as backfilling, the contractor shall notify the Engineer-in-charge of the fact and levels taken jointly with Engineer-in-charge. The earth, morrum, sand, gravel etc. or such materials suitable for filling proposed to be filled under floors and so mentioned in the item of schedule of quantities shall then be brought to site from approved locations and sources

Earth Filling :

The earth, soft morrum etc. so brought shall be filled up in layers of 15 cm depth, each layer being well watered and consolidated by approved hand or mechanical tampers or other suitable means to achieve the required density.

Gravel or sand filling:

Gravel if required to be filled under floors, shall be single washed gravel of approved quality and of size varying from 12mm to 20mm. It shall be uniformly blind with approved type of soil and / or sand to obtain full compaction. Gravel shall be filled in specified thickness and shall be well watered and rammed entirely to the satisfaction of the Engineer-in-charge.

If sand is required to be filled under floors, it shall be clean, medium grained and free from impurities. The filled in sand shall be kept flooded with water for 24hrs. To ensure maximum consolidation shall be done by the contractor at his own cost. The surface shall then be well dressed and got approved from Engineer-in-charge before any other work is taken over the fill.

SITE GRADING /GROUND FORMATION /FILLING:

Site Grading and formation work shall be carried out as indicated in the drawing and as directed by the Architect/Engineer. The debris, rubbish, etc; shall be removed and disposed outside the premises at the cost of the contractor before handing over the Site. The site shall be leveled, formed and dressed as indicated in the drawing.

Before filling is done for land development or embankments all loose sandy loam should be removed and keys formed. No extra Payment shall be done for the above work.

The compaction of the soil shall be carried out by means of road rollers; sheep foot rollers, etc; in case the fill layer exceeds 200 mm in thickness.

EMBANKMENTS:

Forming Embankments and filling to make up levels shall be carried out with approved materials and shall include breaking clods to size less than 25 mm removing all vegetable matter, grass, shrubs, roots, etc; dressing and the formation of slopes. The filling shall be carried out with good quality fill material in layers of not more than 200 mm thickness. Each layer being well watered and consolidated with 8 to 10 M.T. power rollers or sheep foot rollers or other approved equipments.

FILL COMPACTION AND DENSITY:-

The density of the compaction of all the filling mentioned above shall be got tested in the field

as well as in the laboratory as and when directed by the Architect/Engineer at the Contractors cost.

Prior to and during compaction operation, the embankment and/or plinth filling shall have Optimum Moisture Content required for the purpose of compaction and this moisture content shall be fairly uniform throughout the layer. The Dry Bulk Density of the soil fraction in compacted embankment and/or plinth filling material shall not be less than 95% (Ninety five percent) of the maximum Dry bulk density at optimum moisture content obtained in accordance with IS 2720 (part VII).

Tests for Compaction:

The following tests shall be carried out for determining compaction:

- a. Density Moisture relationship: This shall be determined in accordance with IS 2720 Part VII and Part VIII.
- b. Density of soil in the field : This shall be determined in accordance with IS 2720 Part XXVIII or IS 2729 Part XXIX.
- c. Moisture Content : This shall be determined in accordance with IS 2720 Part II.

Standard Proctor Density Test :

Standard Proctor Density Test shall be carried out as and when instructed by the Architect/Engineer at the contractors cost to prove that the compacted earth has attained 95% (Ninety Five Percent) of the maximum Dry Density at optimum Moisture Content.

Lead and Lift:

Lead :

The lead for disposal / deposition of excavated materials shall be as specified in the respective item of work. For the purpose of measurements of lead, the area to be excavated or filled or area on which excavated material is to be deposited/ disposed off shall be divided in suitable blocks and for each of the block, the distance between center lines shall be taken as the lead which shall be measured by the shortest straight line route on the plan and not the actual route adopted.

Lift :

Lift shall be measured from ground level. Excavation up to 1.5m depth below ground level and depositing excavated material on the ground shall be included in the item of earthwork for various kinds of soil. Extra lift shall be measured in unit of 1.5m or part thereof. Obvious lift shall only be measured that is lifts inherent in the lead due to ground slope shall not be measured, except for lead up to 250m. All excavation shall be measured in successive stages of 1.5m stating the commencing level. This shall not apply to cases where no lift is involved as in hill side cutting.

It shall be noted that all the filling soil mentioned in above paragraphs shall be of CNS Soil properties, in case filling soil is not suitable as per soil consultant recommendation or after soil test report , the filling shall be done with CNS Soil.

The properties of CNS Soil are mentioned below:

REQUIRED PROPERTIES OF CNS LAYER

S.No	Property	Very Board Specification Range
1	Grain size analysis i) Clay ii) Silt iii) Sand iv) Gravel	15 – 25% 35 – 50% 30 – 40% ≤ 10%
2	Consistency Limits i) Liquid Limit ii) Plastic Limit iii) Plasticity Index iv) Shrinkage Limit	30 – 50% 20 – 25% 10 – 25% 15% & above
3	a) Swelling pressure when compacted to maximum dry density corresponding to standard Proctor compaction with zero initial compaction moisture constant, for no volume change condition. b) Swelling pressure when compacted to maximum dry density corresponding to standard proctor compaction & initial compaction moisture corresponding to optimum moisture content for no volume change condition.	Less than 0.1 kg/cm ² (10 KN / m ²) Less than 0.05 kg/cm ² (5 KN / m ²)
4	Clay minerals	Preferable Kaolinite and illite.
5	Shear strength of compacted sample compacted to maximum dry density correspond to standard proctor compaction and initial moisture content corresponding to optimum moisture content, but sample tested on saturation. a) from unconfined compression C _u b) from consolidated undrained direct shear test C _{cu} c) ϕ_{cu}	0.15 – 0.35 kg/cm ² (15 to 35 kN/m ²) 0.1 – 0.3 kg / cm ² (10 to 30 kN/m ²) 8° - 15°
6	Compacted density	2 T / m ³

Mode of Measurements :

All excavation in areas having depth more than 30cm. pits, trenches etc. shall be measured net. The dimensions for the purpose of payment shall be reckoned on the horizontal area of the excavations at the base for foundations of the walls, columns, footings, rafts or other foundations, multiplied by the mean depth from the surface of ground determined by levels. Excavation for side slopes will not be paid separately. Excavation in areas having depths less than 30 cms. shall be measured as surface excavation on square meter basis, mentioning the average depth of excavation.

Reasonable working space beyond concrete dimension required for waterproofing and shuttering where considered necessary in the opinion of Engineer-in-charge will be allowed in execution and considered for payment for underground water tank, sump septic tank etc.

Where direct measurements of rock excavation are not possible, volume of rock can be calculated on the basis of length, breadth, and depth of stacks made at site. The net volume shall be worked out by reducing it by 50% taking the voids into consideration as 50%. Similarly to arrive at net quantity to be paid in the case of soil, reduction at 20% of corresponding stack / truck measurements shall be made.

The rate for excavation shall include carting and disposing and leveling the excavated materials within the specified lead. The rate shall also be inclusive of cost of all tools, plants, explosives, shoring dewatering at various stages, labour, materials etc. to complete all the operations specified.

The backfilling and consolidation in sides of foundation and in plinth with excavated material will not be paid for separately. The rate quoted for excavation shall be deemed to have been included the cost of stacking of excavated materials, conveying within the specified lead, picking of selected stacked materials, conveying it to the place of final backfill, compaction to the required proctor density etc.

Payment for filling and consolidation inside the trenches, sides of foundations, plinth etc. with selected materials brought by the contractor other than the excavated material, shall be paid for separately as per the rates in schedule of quantities which includes cost of such materials/ excavation, royalty, its conveyance within the specified lead, watering, consolidating, dressing etc. Actual quantity of consolidated filling shall be measured and paid in cubic meters up to two places of decimal.

The rate quoted in cum. for items of excavation is deemed to include the necessary additional quantity of excavation involved beyond the plan dimensions of the work which may be necessary to be carried out for carrying out the work in an engineering made, decided upon by the contractor. Therefore no extra payment will be made for any excavation done other than the required quantity as per the plan dimension indicated in the drawings.

Measurements for excavation over areas shall be determined by levels or by "Dead men" or both at the discretion of the Engineer-in-charge. If however the Engineer-in-charge decided on measurement by levels, levels of site shall be jointly taken and recorded by the Engineer-in-charge or his representatives and the contractor, before commencement of the work and after completion of the work and the quantity of work done shall be computed based on these levels. The volume of earth work shall be computed based on "Simpson's formula ' or any other approved method at the discretion of the Engineer-in-charge.

5. REINFORCED CONCRETE AND ALLIED WORKS

Scope :

This specification covers the general requirements for concrete to be used on jobs using on-site production facilities including requirements in regard to the quantity, handling, storage of ingredients, proportioning, batching, mixing and testing of concrete and also requirements in regard to the quality. This also covers the transportation of concrete from the mixer to the place of final deposit and the placing, consolidation, curing, protecting, repairing and finishing of concrete.

After award of the work, if so desired by the contractor, he / they may be allowed by the Engineer-in-charge till the designed mix is obtained, to carry out the reinforced concrete work in foundation and plinth as per equivalent nominal mix against the specified design mix concrete as per IS Codes. However, all other specification for design mix shall govern for nominal mix also an nothing extra shall be paid for use of extra cement or else on this account whether the cement is supplied by the Engineer-in-charge or procured by the contractor.

Cement Concrete (Plain and Reinforced):

The quality of materials and method and control of manufacture and transportation of all concrete work in respect of mix, where reinforced or otherwise, shall conform to the applicable portions of these specifications.

The Engineer-in-charge shall have the right to inspect the sources of materials, the layout and operation of procurement and storage of materials, the concrete batching and mixing equipments and the quality control system. Such an inspection shall be arranged by the contractor and the Engineer-in-charge's approval shall be obtained prior to starting the concrete work.

Materials for Standard Concrete:

The ingredients to be used in the manufacture of standard concrete shall consist solely of a standard type Portland puzzling cement, clean sand, natural coarse aggregate, clean water, ice and admixtures if specially called for on drawings or schedule of quantities.

Cement :

Unless otherwise specified or called for by the Engineer-in-charge, cement shall be ordinary Portland cement or / and Portland puzzolena cement in 50 kg bags. The use of bulk cement will be permitted only with the approval of the Engineer-in-charge. Changing of brands or type of cement within the same structure will not be permitted. Ordinary Portland cement (OPC) 43 or 53 grade (as specified or as Decided by Engineer-in-Charge) manufactured as per I.S. specifications ACC/ Ultra tech/ equivalent approved brands shall be procured and used on the work. Joint account of cement consumed at site for every day for items of work carried shall be maintained by the Contractor for verification to ensure effective control on quality of work.

A certified report attesting to the conformity of the cement to IS specifications by the cement manufactures chemist shall be furnished to the Engineer-in-charge, if demanded. In case the cement is required to be arranged by the Contractor, the Contractor will have to make his own arrangement for the storage of adequate quantity of cement. Cement in bulk may be stored in bins or silos which will provide complete protection from dampness, contamination and minimize caking and false set. Cement bags shall be stored in a dry enclosed shed (storage under tarpaulins will not be permitted), well away from the outer walls and insulated from the floor to avoid contact with moisture from ground and so arranged as to provide ready access. Damaged or reclaimed or partly set cement will not be permitted to be used and shall

be removed from the site. The storage bins and storage arrangements shall be such that there is no dead storage. Not more than 12 bags shall be stacked in any tier. The storage arrangement shall be got approved by the Engineer-in-charge. Consignments in cement shall be stored as received and shall be consumed in the order of their delivery

Contractor shall establish cement/concrete/soil testing laboratories at site of work with qualified person to handle the laboratory. Every consignment of cement procured shall accompany test certificate from the company indicating lot No... etc. Sample shall be taken for each lot and sent to Standard Approved Material Testing Laboratory for physical and chemical analysis. The cost of testing shall be born by the Contractor.

Cement held in store for a period of 90 (ninety) days or longer shall be retested before use in work. Should at any time the Engineer-in-charge have reasons to consider that any cement is defective, then irrespective of its origin and / or manufacturers test certificate, such cement shall be tested immediately at a National Test Laboratory or such approved laboratory, and until the results of such tests are found satisfactory, it shall not be used in any work.

Aggregates :

"Aggregate" in general designates both fine and coarse inert materials used in the manufacture of concrete.

"Fine Aggregate" is aggregate most of which passes through 4.75 mm I.S. sieve

."Coarse Aggregate" is aggregate most of which is retained on 4.75 mm I.S. sieve.

All fine and coarse aggregates proposed for use in the work shall be subject to the Engineer-in-charge's approval and after specific materials have been accepted, the source of supply of such materials shall not be changed without prior approval of the Engineer-in-Charge.

Aggregate shall, except as noted above, consists of natural sand, crushed stone and gravel from a source known to produce satisfactory aggregate for concrete and shall be chemically inert, strong, hard, curable against weathering, of limited porosity and free from deleterious materials that may cause corrosion to the r reinforcement or may impair the strength and / or durability of concrete. The grading of aggregates shall be such as to produce a dense concrete of segregation and shall be base on the "mix design" and preliminary test on concrete specified hereinafter.

Aggregate shall comply with the reinforcement of IS:383 & IS:456:2000

Sampling and Testing:

Sampling of the aggregates for mix design and determination of suitability shall be taken under the supervision of the Engineer-in-charge and delivered to the laboratory, well in advance of the schedule placing of concrete. Record of tests which have been made on proposed aggregates and on concrete made from this source of aggregates shall be furnished to the Engineer-in-charge in advance of the work or use, in determining suitability of the proposed aggregate.

Storage of aggregates :

All coarse and fine aggregates shall be stacked separately in stock pile sin the material yard near the work site in bins properly constructed to avoid inter mixing of different aggregates. Contamination with foreign materials and earth during storage and while heaping the materials shall be avoided. The aggregate must be of specified quality not only at the time of receiving at site but also at the time of loading into mixer. Rakers shall be used for lifting the coarse aggregate from bins or stockpiles. Coarse aggregate shall be piled in layers not exceeding 1.00 metres in height to prevent conning or segregation. Each layer shall cover the entire area of the stockpile before succeeding layers are started. Aggregates that have

become segregated shall be rejected. Rejected materials after remixing may be accepted, if subsequent tests demonstrate conformity with required gradation.

Specific Gravity :

Aggregates having a specific gravity below 2.6 (saturated surface dry basis) shall not be used without special permission of the Engineer-in-charge.

Fine Aggregate:

Fine aggregate except as noted above, and for other than light weight concrete shall consist of natural or crushed sand to IS 383. The sand shall be clean, sharp, hard, strong and durable and shall be free from dust, vegetable substances, adherent coating, clay, loam, alkali, organic matter mica, salt or other deleterious substances which can be injurious to the setting qualities / strength / durability of concrete.

Machine made Sand:

Machine made sand will be acceptable, (with prior approval of Engineer – in – charge) provided the constituent rock / gravel composition is sound, hard , dense , non-organic, uncoated and durable against weathering.

Screening and Washing:

Sand shall be prepared for use by such screening or washing or both as necessary, to remove all objectionable foreign matter while separating the sand grains to the required size fractions. Sand with silt content more than 3 percent will not be permitted to be used unless site same is washed and silt content is brought within 3% by weight.

Foreign Material Limitations:

The percentages of deleterious substances in sand, delivered to the mixer shall not exceed the following:

Percent by Weight Substances

	Substances	Percent By Weight	
		Uncrushed	Crushed
I	Material finer than 75 micron IS Sieve	3.00	15.00
II	Shale	1.00	-
III	Coal and Lignite	1.00	1.00
IV	Clay lumps	1.00	1.00
V	Total of all above substances including items (I) to (IV) for uncrushed sand and items (III) and (IV) for crushed sand	5.00	2.00

GRADATION: Unless otherwise directed or approved, the grading of sand shall be within the limit indicated here under :-

IS SIEVE DESIGNATION-	Percentage Passing for			
	Grading Zone-I-	Grading Zone-II	Grading Zone-III	Grading Zone IV

10mm	100	100	100	100
4.75mm	90-100	90-100	90-100	95-100
2.36mm	60-95	75-100	85-100	95-100
1.18mm	30-70	55-90	75-100	90-100
600micron	15-34	35-59	60-79	80-100
300micron	5-20	8-30	12-40	15-50
150micron	0-10	0-10	0-10	0-15

Where the grading falls outside the limits of any particular grading zone of sieves, other than 600 This micron (IS) sieve by not more than 5% it shall be regarded as falling within that grading zone. tolerance shall not be applied to percentage passing the 600 micron (IS) sieve or to percentage passing any other sieve size on the coarser limit of grading zone I or the finer limit of grading zone IV. Fine aggregates conforming to Grading zone IV shall not be used unless mix designs and preliminary tests have shown its suitability for producing concrete of specified strength and workability.

Fineness Modulus:

The sand shall have a fineness modulus of not less than 2.2 or more than 3.2 The fineness modulus is determined by adding the cumulative Percentages retained on the following IS sieve sizes (4.75 mm, 2.36 mm, 1.18mm, 600 micron, 300 micron and 150 micron) and dividing the sum by 100.

Coarse Aggregate:

Coarse aggregate for concrete except as noted above and for other than light weight concrete shall conform to IS 383. This shall consist of natural or crushed stone and gravel, and shall be clean and free from elongated, flaky or laminated pieces, adhering coatings, clay lumps, coal residue, clinkers, sag, alkali, mica, organic matter or other deleterious matter.

The coarse aggregate and fine aggregate shall be tested from time to time as required by the Engineer-in-charge to ascertain its suitability for use in construction and the charges for testing aggregate shall be born by the contractor as specified herein after.

Screening and Washing:

Crushed rock shall be screened and / or washed for the removal of dirt or dust coating, if so demanded by Engineer-in-charge.

Grading :

Coarse aggregates shall be either in single or graded in both the cases. The grading shall be within the following limits:

IS Sieve Designation	Percentage passing for single sized aggregates of nominal size						percentage passing for graded aggregates of nominal size			
	63mm	40m m	20m m	16m m	12.5 mm	10m m	40mm	20mm	16mm	12.5 mm
80mm	100	-	-	-	-	-	100	-	-	-
63mm	85-100	100	-	-	-	-	-	-	-	-
40mm	0-30	85-100	100	-	-	-	95-100	100	-	-
20mm	0-5	0-20	85-100	100	-	-	30-70	95-100	100	100

IS Sieve Designation	Percentage passing for single sized aggregates of nominal size						percentage passing for graded aggregates of nominal size			
	-	-	-	85-100	100	-	-	-	90-100	-
16mm	-	-	-	85-100	100	-	-	-	90-100	-
12.5mm	-	-	-	-	85-100	100	-	-	-	90-100
10mm	0-5	0-5	0-20	0-30	0-45	85-100	10-35	25-55	30-70	40-85
4.75mm	-	-	0-5	0-5	0-10	0-20	0-5	0-10	0-10	0-10
2.36mm	-	-	-	-	-	0-5	-	-	-	-

The pieces shall be angular in shape and shall have granular or crystalline surfaces. Friable, flaky and laminated pieces, mica and shale, If present, shall be only in such quantities that will not in the opinion of Engineer-in-charge, affect adversely the strength and / or durability of concrete the maximum size of coarse aggregate shall be the maximum size specified above, but in no case greater than 1/4 of the minimum thickness of the member, provided that the concrete can be placed without difficulty so as to surround all reinforcement thoroughly and fill the corners of form. Plums above 160mm, and upto any reasonable size can be used in plain mass concrete work of large dimensions upto a maximum limit of 20% by volume of concrete when specifically approved by Engineer-in-charge. For heavily reinforced concrete members, the nominal maximum size of the aggregate shall be 5mm, less than the minimum clear distance between the reinforcing main bars or 5mm less than minimum cover to the reinforcement whichever is smaller. The amount of fine particles occurring in the free state or as loose adherent shall not exceed 1% when determined by laboratory sedimentation tests as per IS 2386. After 24 hours immersion in water, a previously dried sample shall not have gained more than 10% or its over dry weight in air, as determined by IS 2386.

Foreign Material Limitations :

The percentages of deleterious substances in the coarse aggregate delivered to the mixer shall not exceed the following.

	Substances	Percent by Weight	
		Uncrushed	Crushed
I	Material finer than 75 micron IS Sieve	3.00	3.00
II	Coal and lignite	1.00	1.00
III	Clay lumps	1.00	1.00
IV	Soft fragments	3.00	-
V	Total of all the above substances	5.00	5.00

Water :

Water used for both mixing and curing shall be free from injurious amount of deleterious materials; potable waters are generally satisfactory for mixing and curing concrete. In case of doubt, the suitability of water for making concrete shall be ascertained by the compressive strength and initial setting time test specified in IS 456. The sample of water taken for testing shall be typical of the water proposed to be used for concreting, due account being paid to seasonal variation. The samples shall not receive any treatment before testing other than that envisaged in the regular supply of water proposed for use in concrete. The sample shall be stored in a clean container previously rinsed out with similar water.

Average 28 days compressive strength of at least three 150mm concrete cubes prepared with water proposed to be used shall not be less than 90% of the average strength of three similar concrete cubes prepared with distilled water.

The initial setting time of test block made with the appropriate test cement and the water proposed to be used shall not be less than 30 minutes and shall not differ by more than (+) 30 minutes from the initial setting time of control test block prepared with the appropriate test cement and distilled water. The test blocks shall be prepared and tested in accordance with the requirements of IS 4031.

Where water can be shown to contain an excess of acid, alkali, sugar or salt, Engineer-in-charge may refuse to permit its use. As a guide, the following concentrations represent the maximum

Permissible values :

Limits of acidity:

To neutralize 200ml sample of water, using phenolphthalein as an indicator, it should not require more than 2ml of 0.1 normal NaOH. The details of test shall be as given in IS 3025.

Limits of alkalinity :

To neutralize 200ml sample of water, using methyl orange as an indicator, it should not require more than 10ml of 0.1 normal HCL. The details of test shall be as given in IS 3025(Part 18).

Percentage of solids shall not exceed the following:

Table 1
(of IS:456-2000)
Permissible Limit for Solids
(clause 5.4 of IS:456-2000)

SI. No.		Tested as Per	Permissible Limit max
	organic	IS 3025 (Part 18)	200mg/l
	In organic	IS 3025 (Part 18)	3000 mg/l
	Sulphate (as SO ₂)	IS 3025 (Part 24)	400 mg/l for concrete not Containing embedded steel and 500mg/l for reinforced concrete work 2000mg/l
	Chlorides (as Cl)	IS 3025 (Part 32)	2000 mg/l

Design Mix Concrete :

All reinforced concrete in the works shall be "Design Mix Concrete" as defined in I.S. 456-2000. All "Design Mix Concrete" work to be carried out under these specifications shall be in grades designated as per table below:

Grades of Concrete :

Table 2
(of IS:456-2000)

Group	Grade Designation	Specified Character Compressive Strength of 150 mm Cube at 28 Days in N/mm ²
Ordinary Concrete	M 10	10
	M 15	15
	M 20	20
Standard Concrete	M 25	25
	M 30	30
	M 35	35
	M40	40
	M 45	45
	M 50	50
	High Strength Concrete	M 55
M60		60
M65		65
M70		70
M75		75
M 80		80

Note 1 : The characteristic strength is defined as the strength for material below which not more than 5% of the test results are expected to fall.

Note 2 : In the designation of a concrete mix, letter M refers to the mix and the number to the specified characteristic compressive strength of 15cm. cubes at 28 days.

The mix shall be designed to produce the grade of concrete having the required workability and characteristic strength not less than appropriate values given in the table above.

Mix Design:

This is to investigate the grading of aggregates, water cement ratio, workability and the quantity of cement required to give works cubes of the characteristic strength specified. The proportion of the mix shall be determined by weight. Adjustment of aggregate proportions due to moisture present in the aggregate shall be made. Mix proportioning shall be carried out according to the I.S. 10262-1982.

Selection of Water Cement Ratio:

Since different cements and aggregates of different maximum size, grading, surface texture, shape and other characteristics may produce concretes of different compressive strength for the same free water cement ratio, the relationship between strength and free water cement ratio should preferably be established for the materials actually to be used. In the absence of such data, the preliminary free water cement ration (by mass) corresponding to the target strength of 28 days may be selected from the relationship shown of IS. 10262 Page1

Alternately, the preliminary free water ratio (by mass) corresponding to the target average strength may be selected from the relationship in Fig2-IS 10262-1982, Page 8 using the curve corresponding to the 28 days cement strength to be used for the purpose.

Other relevant items to be used with design of mix should strictly conform to the relevant clauses and appendices of IS 10262 – 1982.

The relevant items to be used with design of mix should strictly conform to the relevant clauses and appendices of IS 10262-1982.

The calculated mix proportions shall be checked by means of trial batches.

The contractor may refer Appendix C, clause 3.8 page no. 16 of IS 10262-1982 for an example illustrating the mix design of M-20

The free water cement ration selected as above, should be checked against the limiting water cement ratio for the requirement of durability and the lower of the two values should be adopted.

Whenever there is a change either in required strength of concrete of water cement ratio or workability or the source of aggregates and / or cement, fresh tests shall be carried out to determine the revised proportion of the mix to suit the altered conditions. While designing mix proportions, over wet mixes shall always be avoided.

While fixing the value for water cement ratio for Design Mix assistance may be derived from the standard graph showing the relationship between the 28 days compressive strength of concrete mixes with different water cement ratios and the 7 days compressive strength of cement tested in accordance with IS 269.

It will be contractors sole responsibility to establish the concrete mix designs for different grades of concrete specified in the work consistent with the workability required for nature of work and also taking into consideration the assumed standard deviation which will be expected at site or by establishing the standard deviation based on 30 test results at site for each grade of concrete so as to produce concrete of required strength, durability and surface finish. The materials and proportions used in making the tests to be carried out either at site or under laboratory, conditions shall be similar in all respects to those to be actually employed in the works, as the object of these test is to determine the proportions of cement, aggregates and water necessary to produce the concrete of the required consistency to give such specified strength.

Standard Deviation:

Standard deviation of concrete of each grade shall be determined separately as stated below. When result of sufficient number of tests (at least 30) are not available, than depending on the degree of quality control expected to be exercised at the site, the value of standard deviation given in the following table may be adopted for guidance. Grade of Concrete Suggested Values of S.D

Grade of Concrete	S.D. for different degree of control in N/mm ²		
	Very Good	Good	Fair
M 10	2	2.3	3.3
M 15	2.5	3.5	4.5

Grade of Concrete	S.D. for different degree of control in N/mm ²		
	Very Good	Good	Fair
M 20	3.6	4.6	5.6
M 25	4.3	5.3	6.3
M 30	5	6	7
M 35	5.3	6.3	7.3
M 40	5.6	6.6	7.6
M 45	6	7	8
M 50	6.4	7.4	8.4
M 55	6.7	7.7	8.7
M 60	6.8	7.8	8.8

Control expected for this work is "Very Good" and the contractor shall deploy weigh batcher if required to attain the required control

Degree of Quality Control Expected under different site conditions :

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

Standard Deviation based on Test results :

Number of test results :

The total number of test results required constitute and acceptable record for calculation of standard deviation shall be not less than 30. Attempts should be made to obtain the 30 test results, as early as possible, when a mix is used for the first time.

Standard deviation to be brought upto date :

The calculation of the standard deviation shall be brought upto date after every change of mix design and at least once a month.

Determination of Standard Deviation :

Concrete of each grade shall be analyzed separately to determine its standard deviation. The standard deviation of concrete of a given grade shall be calculated using the following formula from the results of individual tests of concrete of that grade obtained as specified for test strength of sample

Estimated standard deviation $S = 2/n-1$

Where - Deviation of the individual test strength from the average strength of a sample and

n - Number of sample test results

When significant changes are made in the production of concrete (for example changes in the materials used, mix design, equipments or technical control), the standard deviation value shall be separately calculated for such batches of concrete.

Proportioning, Consistency, Batching and Mixing of Concrete :

Proportioning :

Aggregate :

The proportions which shall be decided by conducting preliminary tests shall be by weight. These proportions of cement, fine and coarse aggregates shall be maintained during subsequent concrete batching by means of weight batchers conforming to IS 2722, capable of controlling the weights within one per cent of the desired value. Except where it can be shown to the satisfaction of the Engineer-in-charge that supply of properly graded aggregate of uniform quality can be maintained over the period of work, the grading of aggregate shall be controlled by obtaining the coarse aggregate in different sizes and blending them in the right proportions. The different sizes shall be stacked in separate stock piles. The grading of coarse and fine aggregates shall be checked as frequently as possible, as determined by the Engineer-in-charge, to ensure maintaining of grading in accordance with samples used in preliminary mix design. The materials shall be stock piled well in advance of use.

Cement :

The cement shall be measured by weight. Every facility should be provided to the Engineer-in-charge for sampling and inspection of stored cement at site of work.

Specific Requirement of Cement for Concrete :

The following minimum cement content, required to ensure durability under specified conditions of exposure as per IS 456-2000, shall be met with, in addition to those already stipulated in the specifications:

S.No.	Exposure	Plain Concrete			Reinforced Concrete		
		Minimum Cement Content kg/m ³	Maximum Free Water-Cement Ratio	-Minimum Grade of Concrete'	Minimum Cement Content kg/m ³	Maximum Free Water-Cement Ratio	Minimum Grade of Concrete
1	(2)	(3)	(4)	(5)	(6)	(7)	(8)
2	Mild	220	0.60	-	300	0.55	M 20
3	Moderate	240	0.60	M 15	300	0.50	M 25
4	Severe	250	0.50	M 20	320	0.45	M 30
5	Very severe	260	0.45	M 20	340	0.45	M 35
6	Extreme	280	0.40	M25	360	0.40	M40

NOTES

1. When the maximum water cement ratio can be strictly controlled the cement content in the above table may be reduced by 10%.
2. The minimum cement content is based on 20mm. aggregate. For 40mm aggregate, it should be reduced by about 10% and for 12.5mm aggregate, it should be increased by about 10%.
3. Cement content prescribed in this table is irrespective of the grades of cement and it is inclusive of additions mentioned in 5.2 of IS Code 456-2000. The additions such as fly ash or ground granulated blast furnace slag may be taken into account in the concrete composition with respect to the cement content and water-cement ratio if the suitability is established and as long as the maximum amounts taken into account do not exceed the limit of pozzolona and slag specified in IS 1489 (Part I) and IS 455 respectively.
4. Minimum grade for plain concrete under mild exposure condition is not specified
5. For M50 & M60 Grade Of Design Mix Of Concrete: Micro silica cementious materials and flyash, along with this Hyper-plasticiser are recommended to attain the design straingth of design mix concrete

Specific Requirement of Cement for Plain Cement Concrete mix in volumetric

The below table has to be referred where Plain Concrete mix proportion is in volumetric .
The Table is based on CPWD Specification.

Minimum Grade of Concrete'	Mix Proportion By Weight			Mix Proportion By Volume		
	Cement	Sand	Coarse Aggregate	Cement	Sand	Coarse Aggregate
	(in Kgs)	(in Kgs)	(in Kgs)	Unit	Unit	Unit
M-5	50	230.00	570.00	1.00	4.17	10.86
M-7.5	50	180.00	445.00	1.00	3.27	8.48
M-10 (40MM size)	50	140.00	340.00	1.00	2.54	6.48
M-10 (20MM size)	50	160.00	320.00	1.00	2.90	6.10
M-15(40MM size)	50	95.00	235.00	1.00	1.72	4.48
M-15 (20MM size)	50	110.00	220.00	1.00	2.00	4.19
M-20	50	85.00	165.00	1.00	1.54	3.14

Water:

Only such quantity of water shall be added to the cement and aggregate in the concrete mix as to ensure dense concrete, specified surface finish, and satisfactory workability, consistent with strength stipulated for each class of concrete. The water added to the mix shall be such as not to cause segregation of materials or the collection of excessive free water on the surface on the concrete.

Definition of water cement ratio :

The water cement (W/C) ratio is defined as the weight of water in mix (including the surface moisture of the aggregates) divided by the weight of the cement in the mix.

Water cement ratio The actual water cement ratio to be adopted shall be determined in each instance by contractor and approved by the Engineer-in-charge.

Proportioning by water-cement ratio:

The W/C ratio specified for use by the Engineer-in-charge shall be maintained. Contractor shall determine the water content of the aggregate as frequently as directed by the Engineer-in-charge as the work progresses and as specified in IS 2386 part III and the amount of mixing water added at the mixer shall be adjusted as directed by the Engineer-in-charge so as to maintain the specified W/Ratio. To allow for the variation in their moisture content, suitable adjustments in the weights of aggregates shall also be made.

Consistency and slump :

Concrete shall be of a consistency and workability suitable for the conditions of the job. After the amount of water required is determined, the consistency of mix shall be maintained throughout the progress of the corresponding parts of the work and approved tests e.g. slump test, compacting factor tests etc. in accordance with IS 1199, shall be conducted from time to time to ensure the maintenance of such consistency.

The following tabulation gives a range of workability which shall generally be used for various types of construction unless otherwise instructed by the Engineer-in-charge

Workability of Concrete:

Placing Conditions	Degree of Workability	Slump (mm)
Blinding concrete; Shallow sections; Pavements using pavers	Very low	(Clause 7.1.1 of IS 456-2000) In the 'very low' category of workability where strict control is necessary, for example pavement quality concrete, measurement of workability by determination of compacting factor will be more appropriate than slump (see IS 1199) and a value of compacting factor of 0.75 to 0.80 is suggested.
Mass concrete; Lightly reinforced sections in slabs, beams, walls, columns; Floors; Hand placed pavements; Canal lining; Strip footings	Low	25-75
Heavily reinforced sections in slabs,	Medium	50-100
beams, walls, columns; Slip form Work, Pumped Concrete		75-100
Trench Fill	High	100-150
In-Situ Piling Tremie Concrete	Very High	(Clause 7.1.2 of IS 456-2000) In the 'very high' category of workability, measurement of workability by determination of flow will be appropriate (see IS 9103).

NOTE-For most of the placing conditions, internal vibrators (needle vibrators) are suitable. The diameter of the needle shall be determined based on the density and spacing of reinforcement bars and thickness of sections.

Batching and mixing of concrete:

The material and proportions of concrete materials as established by the preliminary tests for the mix design shall be rigidly followed for all concrete on the project and shall not be changed except when specifically permitted by Engineer-in-charge.

Concrete shall be produced only by weigh batching the ingredients. The mixer and weigh batcher shall be maintained in a clean serviceable condition. The accuracy of weigh batches shall be periodically checked. They shall be set up in level on a firm base and the hopper shall be loaded evenly. The needle shall be adjusted to zero when the hopper is empty. Fine and coarse aggregates shall be weighed separately unless otherwise stated. Volume batching will be permitted only at the discretion of the Engineer-in-charge. Concrete shall be of strength stipulated, all concrete shall be mixed in mechanically operated batch mixers complying with IS 1791 and of approved make with suitable provision for correctly controlling the water delivered to the drum. The quantity of water actually entering the drum shall be checked with the reading of the gauge or valve setting, when starting a job. The test should be made while the mixer is running. The volume of the mixed material shall not exceed the manufacturers rated mixer capacity. The batch shall be charged into the mixer so that some water will enter the drum in advance of cement and aggregate. All water shall be in the drum by the end of the first 15 seconds of the specified mixing time. Each batch shall be mixed until the concrete is uniform in colour, for a minimum period of two minutes after all the materials and water are in the drum. The entire contents of the drum shall be discharged in one operation before the raw materials for the succeeding batches are fed into the drum.

Sampling and Testing Concrete in the field :

Facilities required for sampling materials and concrete in the field, if Engineer-in-charge so desires, shall be provided by contractor at no extra cost. The following equipment with operator shall be made available at Engineers request (all must be in serviceable condition):

1	Cast iron cube moulds 15cm, size	24 nos.(min)
2	Slump cone complete with tamping rod	2 Sets
3	Lab. Balance to weigh upto 5kg with sensitivity of 10gm	1No.
4	Laboratory balance of 2kg. capacity and of sensitivity	1No.
5	I.S. sieves for coarse and fine aggregates	1 set
6	A set of measures from 5ltrs. To 0.4 liter.	set
7	Electric over with thermostat upto 120 degree C	1No.
8	Pycnometer	1No.
9	Calibrated glass jar 1 litre capacity 2 nos.	2No.
10	Glass flasks and metal containers	As required
11	Concrete cube testing machine	1 No.

Testing Charges:

Different tests required to be carried out for concrete works including the mix design, cube tested as per the above specifications shall be got done by the contractor at his own cost in one of the approved laboratories. The choice of laboratory shall rest with Engineer-in-charge. All incidental charges /cost shall be borne by the contractor.

Sampling and Strength Test of Concrete:

Samples from fresh concrete shall be taken as per IS 1199-1959 and cubes shall be made, cured and tested at 28 in accordance with IS 516-1959.

In order to get a relatively quicker idea of the quality of concrete, optional tests on beams for modulus of rupture at (+) 2 hours or at 7 days or compressive strength tests at 7 days may be carried out in addition to 28 days compressive strength test. For this purpose, the values given in table below may be taken for general guidance in the case of concrete made with ordinary cement. In all cases, the 28days compressive strength specified shall alone be the criterion for acceptance or rejection of the concrete. If however, from test carried out in particular job over a reasonably long period, it has been established to the satisfaction of the Engineer-in-charge that a suitable ratio between 28 days compressive strength and modulus rupture 72 (+) 2 hours or 7 days may accepted. The Engineer-in-charge may suitably relax the frequency of 28 days compressive strength, provided the expected strength values at the specified early stage are consistently met.

Optional Tests Requirement of Concrete :

Grade of Concrete	Compressive Strength on 15cm cubes min, at 7 days N/mm ²	Modulus of rupture by beam test min.	
		At 72 (+) 2 hours N/mm ²	At 7 days N/mm ²
M 10	7	-1.2	1.7
M 15	10	1.5	2.1
M 20	13.5	1.7	2.4
M 25	17	1.9	2.7
M 30	20	-2.1	3
M 35	23.5	2.3	3.2
M 40	27	2.5	3.4

Frequency of Sampling:**Sampling procedure:**

A random sampling procedure shall be adopted to ensure that each concrete batch shall have reasonable chance of being tested i.e. the sampling should be spread over the entire period of concreting and cover all fixing units.

Frequency:

The minimum frequency of sampling of concrete of each grade shall be in accordance with following

Quantity of concrete in the work (in cum)	Number of samples
1-5	1
6-15	2
16-30	3
31-50	4
51 and above	4 plus one additional for each additional 50 cum. or part thereof

At least one sample shall be taken from each shift.

Test Specimen :

Three test specimen shall be made from each sample for testing at 28 days. Additional cubes may be required for various purposes such as to determine the strength of concrete at 7 days or at the time of striking the formwork or to determine the duration of curing or to check the testing error. Additional cubes may also be required for testing cubes cured by accelerated methods as described in IS 9013-1978. The specimen shall be tested as described in IS 516-1959.

Test Strength of Samples :

The test strength of the samples shall be the average of the strength of three specimen. The individual variation should not be more than (+) 15 percent of the average.

Consistency:

Slump test shall be carried out as demanded by the Engineer-in-charge and invariably from the same batch of concrete from which the test cubes are made. Slump tests shall be done immediately after sampling.

Standard Deviation:

Vide under the Head of **Determination of Standard Deviation.**

Acceptance Criteria:

The concrete shall be deemed to comply with the strength requirement if :

Every sample has a test strength not less than the characteristic value, is in each case not less than the greater of :

1. The characteristic strength minus 1.35 times the standard deviation and
 2. 0.80 time the characteristic strength : and the average strength of all the samples is not less than the characteristic strength plus :
{1.65-1.65/ Number of samples} times the standard deviation
1. The concrete shall be deemed not to comply with the strength requirements if :
 - a The strength of any sample is less than the greater of
 1. The characteristic strength minus 1.35 times the standard deviation and
 2. 0.80 times the characteristic strength; or
 - b The average strength of all the samples is less than the characteristic strength plus
{1.65 – 3.00/ Number of samples} times the standard deviation

Concrete which does not meet the strength requirements as specified hereinbefore but has a strength greater than that required may, at the discretion of the designer, be accepted as being structurally adequate without further testing.

If the concrete is deemed not to comply pursuant to acceptance criteria, the structural adequacy of the parts affected shall be investigated and any consequential action as needed shall be taken. Concrete of each grade shall be assessed separately. Concrete shall be assessed daily for compliance.

Concrete of each grade shall be rejected if it is porous or honey-combed: its lacing has been interrupted without providing a proper construction joint; the reinforcement has been displaced beyond the tolerances specified or construction tolerances have not been met. However, the hardened concrete may be accepted after carrying out suitable remedial measures to the satisfaction of the Engineer-in-charge

Admixtures:

General:

Admixture may be used in concrete only with the approval of engineer-in-charge based upon evidence that, with the passage of time neither the compressive strength nor its durability reduced. When admixtures are used, the designed concrete mix shall be corrected accordingly. Admixtures shall be used as per manufacturer’s instructions and in the manner and with the control specified by Engineer-in-charge. rate quoted for concrete should include cost and lab our for admixture. No extra payment will be made.

I Calcium Chloride:

**Limits of Chloride Content of Concrete
(Clause 8.2.5.2 of IS: 456-2000)**

SI No.	Type or Use of Concrete	Maximum Total Acid Soluble Chloride Content Expressed as of concrete
1	Concrete containing metal and steam cured at elevated temperature and pre-stressed concrete	0.4
2	Reinforced concrete or plain concrete containing embedded metal	0.6
3	Concrete not containing embedded metal or any material curing protection from chloride	3.0

For details specifications follow IS 456:2000

II Air Entraining Agents :

Where specified and approved by Engineer-in-charge, neutralized vinsol resin or any other approved air entraining agent may be used to produce the specified amount of air in the concrete mix and these agents shall conform to the requirements of ASTM standard 6.260. Air Entraining admixtures for concrete. The recommended total air content of the concrete is 4% (+) 1%. The method of measuring air content shall be as per IS 1199.

III Retarding Admixtures:

Where specified an approved by Engineer-in-charge, retarding agents shall be added to the concrete mix in quantities specified by Engineer-in-charge.

IV Water Reducing Admixtures :

Where specified and approved by Engineer-in-charge, water reducing lingo sulfonate mixture shall be added in quantities specified by Engineer-in-charge. The admixtures shall be added in the form of absolution.

V Water Proofing Agents:

Where specified and approved by Engineer-in-charge, chloride and sulphate free water proofing agents shall be added in quantities specified by Engineer-in-charge.

VI Other Admixtures:

Engineer-in-charge may at his discretion, instruct contractor to use any other admixture in the concrete.

Inspection of Structures:

Immediately after stripping the form work, all concrete shall be carefully inspected and any defective work or small defects, either removed or made good before concrete has thoroughly hardened, as instructed by engineer-in-charge.

In case of doubt regarding the grade of concrete used or results of cube strength are observed to be lower than the designed strength as per specifications at 28 days, compressive strength test of concrete based on core test, ultrasonic test and / or load test shall be carried out by the digital Engineer-in-charge all at the cost of the contractor. In case these tests do not satisfy the requirements, the Engineer-in-charge will be at liberty to reject the concrete, and the contractor, at his own cost, has to dismantle and re-do the same or carry out such remedial measures as approved by the Engineer-in-charge.

Testing of Structures:

Optional Tests:

Engineer-in-charge, if he so desires, may order for tests to be carried out on cement, sand, coarse aggregate, water etc. in accordance with the relevant Indian Standards.

Tests on Cement will be carried out and shall include (i) Fineness test (ii) test for normal consistency, (iii) test for setting time (iv) test for soundness (v) test for compressive strength (vi) test for heat of hydration (by experiment and by calculations) in accordance with IS-269.

Tests on sand shall include (i) sieve test (ii) test for organic impurities (iii) decantation test for determining clay and silt content (iv) specific gravity test (v) test for unit weight and bulk age factor (vi) test for sieve analysis and fineness modulus.

Tests on coarse aggregate shall include (i) sieve analysis (ii) specific gravity and unit weight of dry, loose and rodded aggregate (iii) soundness and alkali aggregate reactivity (iv) petrography examination (v) deleterious materials and organic impurities (vi) test for aggregate crushing value.

The test on aggregate would normally be ordered to be carried out only if Engineer-in-charge feels the materials are not in accordance with the specifications or if the specified concrete strengths are not obtained and shall be referred by contractor at an approved test laboratory. Contractor shall have to pay all the charges of optional tests. If the work cubes do not give the stipulated strengths, Engineer-in-charge reserves the right to ask Contractor to dismantle such portions of the work, which in his opinion are unacceptable and re-do the work to the standards stipulated at contractor's cost.

The unit rate for concrete shall be all inclusive including making preliminary mix design and test cubes, works cubes, testing them as per specifications, slump tests, optional tests etc.

Complete. The contractor will have to make arrangements for transportation to the laboratory and testing charges will be borne by the contractor.

The contractor should also conduct conclusive tests such as ultrasonic pulse test, core test etc. to prove the suitability of concrete, in case cube tests give unsatisfactory results. The cost of the conclusive test should be borne by the contractor.

Core test :

The points from which cores are to be taken and the number of cores required, shall be at the discretion of the whole of concrete concerned. In no case, however, shall fewer than three cores be tested. Cores shall be prepared and tested as described in IS 516-1959.

Concrete in the member represented by a core test shall be considered acceptable if the average equivalent cube strength of the cores is equal to at least 80% of the cube strength of the grade of concrete specified for the corresponding age and no individual core has a strength less than 75%.

In case the core test results do not satisfy the requirements as above or where such tests have not been done, load test (see 4:11:3) may be resorted to.

Load tests on parts of structure :

Load tests should be carried out as soon as possible after expiry of 28 days from the time of placing of concrete.

The structure should be subjected to a load equal to full dead load of the structure plus 1.25 times the imposed load period of 24 hours and then the imposed load shall be removed.

Note : Dead load includes weight of the structural members plus weight of finishes and walls or partitions , if any, as considered in the design.

The deflection due to imposed load only shall be recorded. If within 24 hours of removal of the imposed load, the structure does not recover atleast 75% of the deflection under super imposed load, the test may be repeated after a lapse of 72 hours. If the recovery is less than 80% the structure shall be deemed to be unacceptable.

If the maximum deflection in mm shown during 24 hours under load is less than $40L^2/D$, where L is the effective span and D the overall depth of the section in mm, it is not necessary for recovery to be measured and the recovery provision above will not apply.

Other non-destructive test methods may be adopted, in which case the acceptance criteria shall be agreed upon between the Engineer-in-charge and the Contractor and the test shall be done under expert guidance.

Testing of Underground Water Tank / Septic Tank / Underground structures :

The tank will be tested after the completion according to the procedure laid down here :

The middle compartment shall be filled first to its full height and the leakage if any shall be checked on its outer surfaces if found, the same shall be examined carefully and defects rectified / grouted if necessary. The drop in level exceeds 20mm and shows any leakage in the said walls, necessary steps shall be taken in consultation with the Engineer-in-charge.

After this compartment is tested to the satisfaction of the Engineer-in-charge, all water from middle compartment shall be stepped into side compartment to the full height and checked for water leakages from the outer surfaces of the tank as inner surface of the middle compartment. The drop in level of surface of water shall also be checked as stated and defects rectified.

The external surface of the tank shall the be plastered and cured as per the specifications and backfilling shall be taken up thereafter. The water from the compartments shall then be pumped out and the inner surface of the tank in all compartments then be checked and defects rectified .

After satisfactory completion of checks, internal plaster shall be taken up as specified in the specifications.

The contractor shall be responsible for carrying out the complete test, rectifying the leakages if any. The cost of providing equipments, labor for carrying out tests shall be borne by the contractor. The rates quoted for concreting items for constructing underground water tank shall be inclusive of testing of RCC tank for water tightness as per above specifications. Contractor shall make his own arrangement for filling the tank. The contractor shall make his own arrangement for water required for construction and labour etc. as per contract conditions at his own cost.

Unsatisfactory Tests :

Should the results of any test prove unsatisfactory, or the structure shown signs of weakness, undue deflection or construction, contractor shall remove and rebuild the member or members involved to carry out such other remedial measures as may be required by Engineer-in-charge. Contractor shall bear the cost of so doing, unless the failure of the member or members to fulfill the test conditions is proved to be solely due to faulty design. The cost of load and tests shall be borne by contractor if the tests show unsatisfactory results; otherwise such cost will be borne by the Owner.

Concrete in Alkali Soils and Alkaline Water :

Where concrete is liable to attack from alkali salts or alkaline water, special cements containing low amount of tricalcium... shall be used, if so specified on the drawings. Such concrete shall have minimum cement content, for different exposes... attached as given in table 19 and 20 in appendix A of IS 456-2000. If specified by Engineer-in-charge, additional protection shall be obtained by the use of chemically resistant stone facing or a layer of plaster of Paris covered with suitable fabric, such as jute thoroughly impregnated with tar.

Preparation Prior to Concrete Placement, Final Inspection & Approval :

Before the concrete is actually placed in position, the inside of the form work shall be inspected to see that they have been cleaned and oiled. Temporary openings shall be provided to facilitate inspection, especially at bottom of columns and wall forms, to permit removal of saw dust, wood shavings, binding wire, rubbish, dirt etc. Opening shall be placed or holes drilled so that these materials and water can be removed easily. Such openings/ holes shall be later suitable plugged.

The various traders shall be permitted ample time to install drainage and plumbing lines, floor and trench drain, conduits, hangers, anchors, inserts, sleeves, bolts, frames and other miscellaneous embedment to be cast in the concrete as indicated on the drawing or as necessary for the proper execution of the work. All such embedment shall be correctly positioned and securely held in the forms to prevent displacement during depositing and vibrating of concrete.

Slots , openings, holes pockets etc. shall be provided in the concrete work in the positions indicated in the drawings or as directed by the Engineer-in-charge.

Reinforcement and other items to be cast in concrete shall have clear surfaces that will not impair bond.

Prior to concrete placement, all works shall be inspected and approved by Engineer-in-charge, and if found unsatisfactory, concrete shall not be poured until all defects have been corrected at contractors cost.

Approval by Engineer-in-charge of any and all materials and work as required herein shall not relieve contractor from his obligations to produce finished concrete in accordance with the drawings and specifications.

Rain or Wash Water :

No concrete shall be placed in wet weather or on a water covered surface. Any concrete that has been washed by heavy rain shall be entirely removed, if there is any sign of cement and sand having been washed away from the concrete mixture. To guard against damage which may be caused by rain, the works shall be covered with tarpaulins immediately after the concrete has been placed and compacted before leaving the work unattended. Any water accumulating on the surface of the newly placed concrete shall be removed by approved means and no further concrete shall be placed thereon until such water is removed..

Bonding Mortar:

Immediately before concrete placement begins, prepared surfaces, except form work, which will come in contact with concrete to be placed, shall be covered with a bonding mortar of same strength of concrete.

Transportation:

All buckets, containers or conveyers used for transporting concrete shall be mortar-tight. All means of conveyance shall be adopted to deliver concrete of the required consistency and plasticity without segregation or loss of slump whatever method of transportation is employed. Chute shall not be used to transport the concrete without the written permission of the Engineer-in-charge and concrete shall not be rehandled before placing.

Retempered or Contaminated Concrete :

Concrete must be placed in its final position before it becomes too stiff to work. On no account water shall be added after the initial mixing. Concrete which has become stiff or has been contaminated with foreign materials and which has not been placed within half an hour of mixing water with cement shall be rejected.

Cleaning of Equipment :

All equipments used for mixing, transporting and placing of concrete shall be maintained in clean condition. All pans, buckets, hoppers, chutes, pipe lines and other equipments shall be thoroughly cleaned after each period of placement.

Procedure for placing of concrete :

1 Engineers approval of Equipment and Methods:

Before any concrete is placed, the entire placing programme, consisting of equipment, layout proposed procedures and methods shall be submitted to Engineer-in-charge and no concrete shall be of such size and design to ensure a practically continuous flow of concrete during depositing without segregation of materials, considering the size of the job and placement location.

2 Time Interval between Mixing and Placing :

Concrete shall be placed in final position before the cement reaches its initial set and concrete shall normally be compacted in its final position within thirty minutes of leaving the mixer and once compacted it shall not be disturbed.

3 Avoiding Segregation:

Concrete shall in all the cases be deposited as nearly as practicable directly in its final position and shall not be rehandled or caused to flow in a manner which will cause segregation, loss of materials displacement of reinforcement, shuttering or embedded inserts or impair its strength. For locations where direct placement is not possible, and in narrow forms, contractor shall provide suitable prop and Elephant Trunks to confine the movement of concrete. Special care shall be taken when concrete is dropped from height, especially if reinforcement is in the way, particularly in columns and thin walls.

4 Placing by Manual Labour :

Except when otherwise approved by Engineer-in-charge, concrete shall be placed in the shuttering by shovels or other approved implements and shall not be dropped from a height more than 1.0m or handle in a manner which will cause segregation.

5 Placing by Mechanical Equipment:

The following specifications shall apply when placing of concrete by use of mechanical equipment is specially called for while inviting bids or is warranted, considering the nature of work involved. The control of placing shall begin at the mixer discharge. Concrete shall be discharged by a vertical drop into the middle of the bucket of hopper and this principle of a vertical discharge of concrete shall be adhered to throughout all stages of delivery until the concrete comes to rest in its final position.

Type of buckets:

All concrete shall be conveyed from the mixer to the place of final deposit in suitable buckets, dumpers, containers which shall be leak tight. All means of conveyance shall be adopted for delivering concrete to the required consistency / Workability and plasticity without segregation.

Central bottom dump buckets of a type that provides for positive regulation of the amount and rate of deposition of concrete in all dumping position shall be employed.

Operation of Bucket :

In placing concrete in large open areas, the bucket shall be spotted directly over the position designated and then lowered for dumping. The open bucket shall clear the concrete already in place and the height of drop shall not exceed 1.0m. The bucket shall be opened slowly to avoid high vertical bounce. Dumping of buckets on the swing or in any manner which results in separation of ingredients or disturbance of previously placed concrete will not be permitted.

Placement in restricted forms:

Concrete placed in restricted forms by borrows, buggies, cars, short chutes or hand shoveling shall be subject to the requirement for vertical delivery of limited height to avoid segregation and shall be deposited as nearly as practicable in its final position.

Chutting :

Where it is necessary to use transfer chutes, specific approval of Engineer-in-charge must be obtained on the type, length, slopes, baffles, vertical timing of operations. These shall be so arranged that almost continuous flow of concrete is obtained at the discharge end without segregation. To allow for the loss of mortar against the sides of the chutes, the first mixes shall have less coarse aggregate.

During cleaning of chutes, the waste water shall be kept clear of the forms. The concrete shall not be permitted to fall from the end of the chutes by more than 1.0 m. Chutes, when approved for use, shall have slopes not flatter than 1 vertical to 3 horizontal and not steeper than 1 vertical to 2 horizontal, chutes shall be of metal or metal line and of rounded cross section. The slopes of all chute sections shall be approximately same. The discharge end of the chutes shall be maintained above the surfaces of the concrete in the forms.

Placing by Pumping / Pneumatic Placers:

Concrete may be conveyed and placed by mechanically operated equipments e.g. pumps or pneumatic placers, only with the written permission of Engineer-in-charge. The slump shall be held of the minimum, necessary for conveying concrete by this method.

When pumping is adopted, before pumping of concrete is started, the pipelines shall be lubricated with one or two batches of mortar composed of one part cement and two parts sand. The concrete mix shall specially designed to suit pumping. Care shall be taken to avoid stoppages in work once pumping has started.

When pneumatic placer is used, the manufactures advice on layout of pipeline shall be lubricated with one or two batches of mortar composed of one part cement and two parts sand. The concrete mix shall specially designed to suit pumping. Care shall be taken to avoid stop pages in work once pumping has started.

When pneumatic placer is used, the manufacturers advice on layout of pipeline shall be followed to avoid blockages and excessive wear. Restraint shall be provided at the discharge box to cater for the reaction at the end.

Manufacturers advice shall be followed regarding concrete quality and all other related matters when pumping / pneumatic placing equipments are used.

Concrete in Layers :

Concreting, once started, shall be continuous until the pour is completed. Concrete shall be placed in successive horizontal layers of uniform thickness ranging from 15cm to 90cm. a directed by Engineer-in-charge. These shall be placed as rapidly as practicable to prevent the formation of cold joints or places of weakness between each succeeding layers within the pour. The thickness of each layer shall be such that it can be deposited before the previous layer has stiffened. The bucket loads or other units of deposit, shall be poured progressively along the face of the layer with such overlap as will facilitate spreading the layer to uniform depth and texture with a minimum of shoveling stone into mortar rather than mortar on to stones. Such a condition shall be corrected by redesign of mix or other means, as directed by Engineer-in-charge.

Bedding of layers :

The top surface of each pour and bedding places shall be approximately horizontal unless otherwise instructed.

Compaction :

Concrete shall be compacted during placing, with approved vibrating equipment, until the concrete has been consolidated to the maximum practicable density, is free of pockets of coarse aggregate and fits tightly against all form surfaces, reinforcement and embedded fixtures. Particular care shall be taken to ensure that all concrete placed against the form faces and into corners of forms or against hardened concrete at joints is free from voids or cavities. The use of vibrators shall be consistent with the concrete mix and caution is to be exercised not to over vibrate the concrete to the point of segregation.

Type of Vibrators :

Vibrator shall conform to IS specifications. Type of vibrators to be used shall depend upon the structure where concrete is to be placed. Shutter vibrators, to be effective, shall be firmly secured to the form work which must be sufficiently rigid to transmit the vibrations strong enough not to be damaged by it. Immersion vibrator shall have No load frequency amplitude and acceleration as per IS 2505 depending on the size of the vibrator. Immersion vibrators in sufficient numbers and each of adequate size shall be used to properly consolidate all concrete. Tapping or external vibrating of forms by hand tools or immersion vibrators will not be permitted.

Use of Vibrators :

The exact manner application of the most suitable machines for the purpose must be carefully considered and operated by experienced men. Immersion vibrators shall be inserted vertically at points not more than 450mm apart and withdrawn when air bubbles ceases to come to the surface. Immersion vibrators be used to transport concrete inside the forms. Particular attention shall be paid to vibration at the top of lift, eg. in a column or wall.

Melding successive batches :

When placing concrete in layers, which are advancing horizontally as the work progress, great care shall be exercised to ensure adequate vibration, blending and melding of the concrete between the successive layers.

Penetration of Vibrations:

The immersion vibrator shall penetrate the layer being placed and also penetrate the layer below when the under layer is still plastic to ensure good bond and homogeneity between the two layers and prevent the formation of cold joints.

Vibrating against reinforcement :

Care shall be taken to prevent contact of immersion vibrators agents reinforcement steel. Immersion vibrators shall not be allowed to come in contact with reinforcement steel after start of initial set. they shall also not be allowed to come in contact with forms of finished surfaces.

Use of form attached Vibrators :

Form attached vibrators shall be used only with specific authorization of Engineer-in-charge.

Use of surface vibrators :

The use of surface vibrators will not be permitted under normal conditions. However, for thin slabs, such as highways, runways and similar construction, surface vibrations by specifically designed vibrators may be permitted, upon approval of Engineer-in-charge.

Stone Pockets and Mortar Pondages :

Formation of stone pockets or mortar pondages in corners and against faces of forms shall not be permitted. Should these occur, they shall be dug out, reformed and refilled to a sufficient depth and shape for thorough bonding as directed by Engineer-in-charge.

Placement Interval :

Except when placing with slip forms, each placement of concrete in multiple lift work, shall be allowed to set for at least 24 hours after the final set of concrete and before the start of a subsequent placement.

Special provision in placing :

When placing concrete in walls with openings, in floors of integral slab and beam construction and other similar conditions, the placing shall stop when the concrete reaches the top of the opening in walls or bottom horizontal surface of the slabs as the case may be. Placing shall be resumed before the concrete in place takes initial set, but not until it has had time to settle as determined by Engineer-in-charge.

Placing Concrete through reinforcing steel :

While placing concrete through reinforcing steel, care shall be taken to prevent segregation of the coarse aggregate. Where the congregation of steel makes placing difficult, it may be necessary to temporarily move the top steel aside to get proper placement and restore reinforcing steel to design position.

Bleeding:

Bleeding or free water on top of concrete being deposited into the forms, shall be caused to stop the concrete poured and the conditions causing this defect corrected before any further concreting is resumed.

Construction Joints and Keys :

Concrete shall be placed without interruption until completion of the part of the work between predetermined construction joints, as specified therein after. Time lapse between the pouring of adjoining units shall be as specified in the drawing or as directed by Engineer-in-charge. If stopping of concreting becomes unavoidable anywhere, a properly formed construction joint shall be made where the work is stopped. Joints shall be either vertical or horizontal, unless shown otherwise in drawings. In case of an inclined or curved member, the joints shall be at right angles to the axis of the member. Vertical joints in walls shall be kept to a minimum. Vertical joints shall be formed against a stop board, horizontal joints shall be level and wherever possible, arranged, so that the joint lines coincide with the architectural features of the finished work. Battens, shall be nailed to the form to ensure a horizontal line and if directed, shall also be used to form a grooved joint. For tank walls, similar work joints shall be formed as per IS 3370. Concrete that is in the process of setting shall not be disturbed or shaken by traffic either on the concrete itself or upon the shuttering, horizontal and vertical

construction joints and shear keys shall be located and shall conform in detail to the requirements of the plans unless otherwise directed by Engineer-in-charge. Where not described, the joints shall be in accordance with the following:

Dowels :

Dowels for concrete work, not likely to be taken up in the near future, shall be wrapped in tar paper and burlap.

Treatment of construction joints on resuming Concreting :

Drier shall be used for the top lift or horizontal pours to avoid a laitance. All laitance and loose stones shall be thoroughly and carefully removed by wire brushing / hacking and surface washed.

Just before concreting is resumed, the roughened joint surface shall be thoroughly cleaned and loose matter removed and then treated with a thin layer of cement grout of proportion specified by Engineer-in-charge and worked well into the surface. The new concrete shall be well worked specially against the prepared face before the grout mortar sets. Special care shall be taken to obtain thorough compaction and to avoid segregation of the concrete along the joint plane.

Curing, Protecting, Repairing and Finishing :

Curing :

All concrete shall be cured by keeping it continuously damp for the period of time required for complete hydration and hardening to take place. Preference shall be given to the use of continuous sprays or ponded water, continuously saturated covering of sacking, canvas, hessian or other absorbent materials, or approved effective curing compounds applied with spraying equipment capable of producing a smooth, even textured coat. Extra precautions shall be exercised in curing concrete during cold and hot weather as outlined hereinafter. The quality of curing water shall be the same as that used for mixing concrete.

Curing with Water :

Fresh concrete shall be kept continuously wet for a minimum period of 14 days from the date of placing of concrete, following a lapse of 12 to 24 hours after laying concrete. The curing of horizontal surfaces exposed to the drying winds shall however begin immediately the concrete has hardened. Water shall be applied to unformed concrete surfaces within one hour after concrete had set. Water shall be applied to formed surfaces immediately upon removal of forms.

Continuous Spraying :

Curing shall be assured by use of an ample water supply under pressure in pipes, with all necessary appliances of hose sprinklers as spraying devices. Continuous fine mist spraying or sprinkling shall be used, unless otherwise specified or approved by Engineer-in-charge.

Alternate curing Methods :

Whenever in the judgment of Engineer-in-charge, it may be necessary to omit the continuous spray method, covering by clear sand or other approved means such as wet gunny bags, which will prevent loss of moisture from the concrete, during or after the curing period, will not be permitted. Concrete shall be kept continuously wet during the curing period.

For curing of concrete in pavements, side-walks, floors, flat roofs or other level surfaces, the ponding method of curing is preferred. The method of containing the ponded water shall be approved by Engineer-in-charge. Special attention shall be given to edges and corners of the slab to ensure proper protection to these areas. The ponded areas shall be continuously filled with water during the curing period.

Curing Compounds :

Surface coating type curing compound shall be used only on special permission of Engineer-in-charge. Curing compounds shall be liquid type while pigmented, conforming to U.S. Bureau of Reclamation specification. No curing compound shall be used on surface where future blending with concrete, water or acid proof membrane or painting is specified.

Curing Equipment :

All equipments and materials required for curing shall be on hand and ready for use before concrete is placed.

Protecting Fresh Concrete :

Fresh concrete shall be protected from the elements, from defacement and damage due to construction operations by leaving forms in place for ample period as specified later in this specification. Newly placed concrete shall be protected by approved means such as tarpaulins from rain, sun and winds. Steps as approved by Engineer-in-charge, shall also be taken to protect immature concrete from damage by debris, excessive loading, vibrations, abrasion or contact with other materials etc. that may be warned against and prevented from disturbing green concrete during its setting period, , if it is necessary that workmen enter the area of freshly placed concrete, Engineer-in-charge may require that bridges be placed over the area.

Repair and Replacement of unsatisfactory Concrete :

Immediately after the shuttering is removed, the surface of concrete shall be carefully gone over and all defective areas called to the attention of Engineer-in-charge who may permit patching of the defective areas or else reject the concrete unit either partially or entirely. Rejected concrete shall be removed and replaced by contractor at no additional expense to the Owner. Holes left by form bolts etc. shall be filled up and made good with mortar composed of one part of cement to one and half parts of sand passing through 2.36mm. IS sieve after removing any loose stones adhering to the concrete. Mortar filling shall be struck off flush at the face of the concrete. Concrete surface shall be finished as described under the particular item of work.

Superficial honey combed surfaces and rough patches shall be similarly made good immediately after removal of shuttering in the presence of Engineer-in-charge and superficial water and air holes shall be filled in. The mortar shall be well worked into the surface with wooden float. Excess water

shall be avoided. Unless instructed otherwise by Engineer-in-charge, the surface of the exposed concrete placed against shuttering shall be rubbed down immediately on removal for shuttering to remove fine or other irregularities, care being taken to avoid damaging the surfaces. Surface irregularities shall be removed by grinding.

If reinforcement is exposed or the honey combing occurs at vulnerable position e.g. ends of beams or columns, it may be necessary to cut out the member completely or in part and reconstruct. The decision of Engineer-in-charge shall be final in this regard. If only patching is necessary, the defective concrete shall be cut out till solid concrete is reached (or to a minimum depth of 25mm), the edges being cut perpendicular to the affected surface or with a small under cut if possible, anchors, tees or dowels shall be provided in slots whenever necessary to attach the newly concrete securely in place. An area extending several

centimeters beyond the edges and the surfaces of the prepared voids shall be saturated with water for 24 hours immediately before the patching material is placed.

Use of Epoxy :

The use of epoxy for bonding fresh concrete used for repairs will be permitted upon written approval of Engineer-in-charge. Epoxies shall be applied in strict accordance with the instruction of the manufacturer.

Method of repair :

Small size holes having surface dimensions about equal to the depth of the hole, holes left after removal of form holes, grout insert holes and slots cut for repair of cracks shall be repaired as follows:

The hole to be patched shall be roughened and thoroughly soaked with clean water until absorption stops. A 5mm thick layer of grout of equal parts of cement and sand shall be well brushed into the surface to be patched followed immediately by the patching concrete which shall be well consolidated with wooden float and left slightly proud of the surrounding surface. The concrete patch shall be built up in 10mm thick layers. After an hour more, depending upon weather conditions, it shall be worked off flush with a wooden float and a smooth finish obtained by wiping with Hessian. Steel trowel shall not be used for this purpose. The mix for patching shall be of the same materials and in the same proportions as that used in the concrete being repaired, although some reduction in the maximum size of the coarse aggregates may be necessary and the mix shall be kept as dry as possible.

Mortar filling by air pressure (guniting) shall be used for repair of areas too large and / or too shallow for patching with mortar. Patched surfaces shall be given a final treatment to match the color and texture of the surrounding concrete. White cement shall be substituted for ordinary cement, if so directed by Engineer-in-charge, to match the shade of the patch with the original concrete.

Curing of Patched Work :

The patched area shall be covered immediately with an approved non-staining water saturated material such as gunny bags, which shall be kept continuously wet and protected against sun and wind for a period of 24 hours. Thereafter, the patched area shall be kept wet continuously by a fine spray of sprinkling water for not less than 10 days.

Approval by Engineer-in-charge :

All materials, products and operations used in the repair of concrete as also the finished repair work shall be subject to the approval of Engineer-in-charge. All fillings shall be tightly bonded to the concrete and shall be sound, free from shrinkage cracks after the fillings have been cured and dried.

Finishing :

This specification is intended to cover the treatment of concrete surfaces of all structures.

Finish for Formed surfaces :

The type of finish for formed concrete surfaces shall be as follows, unless otherwise specified by the Engineer-in-charge.

For surface below grade, which will receive waterproofing treatment, the concrete shall be free of surface irregularities which would interfere with proper application of the water proofing materials which is specified for use.

Unless specified, surfaces which will be exposed when the structure is in service shall receive no special finish, except repair of damaged or defective concrete, removal of fins and abrupt irregularities, filling of hole left by form ties and rods and clean up of loose or adhering debris.

Surfaces which will be exposed to the weather and which would normally be leveled, shall be sloped for drainage. Unless the drawing specify a horizontal surface or shows the slope required, the tops of narrow surfaces such as staircase treads, walls, curbs and parapets shall be sloped across the width approx. as 1 in 30, Broader surface such as walkways, roads, parking areas and platforms shall be sloped about 1 in 50. Surfaces that will be covered by backfill or concrete, sub floors to be covered with concrete topping, terrazzo or quarry tile and similar surfaces shall be smooth, screened and leveled to produce even surfaces. Surface irregularities shall not exceed 6mm. Surfaces which will not be covered by backfill, concrete or tile topping such a outside decks, floors of galleried and sumps, parapets, gutters, side walks, floors and slabs shall be consolidated, screened and floated.

Excess water and laitance shall be removed before final finishing. Floating may be done with hand with hand or power tools and started as soon as the screeded surface has attained a stiffness to permit finishing operations and shall be the minimum required to produce a surface uniform in textured free from screed marks or other imperfections. Joints and edges shall be tooled as called for on the drawings or as faceted by Engineer-in-charge.

Standard Finish for Exposed Concrete :

Exposed concrete shall measured any concrete other than floors or slabs exposed to view upon completion of the job. Unless otherwise specified on the drawings, the standard finish for exposed concrete shall be of smooth finish.

A smooth finish shall be obtained with use of lined or plywood form having smooth and even surfaces d edges. Panels and form linings shall be of uniform size and be as large as practicable and installed with closed joints. Upon removal of forms, the joint marks shall be smoothed off and all blemished, projections etc. removed, leaving the surfaces reasonably smooth and unmarred.

Integral Cement concrete Finish:

When specified on the drawings, an integral cement concrete finish of specified thickness for floors and slabs shall be applied either monolithic or bonded, as specified in the drawings and as per IS2571. The surface shall be compacted and then floated with a wooden float or power floating machine. The surface shall be tested with a straight edge and any high and low spots eliminated. Floating or toweling of the finish shall be permitted only after all surface water has evaporated. Dry cement or a mixture of dry cement and sand shall not be sprinkled directly on the surface of the cement finish to absorb moisture or to stiffen the mix.

Rubbed Finish :

A rubbed finish shall be provided only on exposed concrete surfaces as specified on the drawings. Upon removal of forms, all fins and there projections on the surfaces shall be carefully removed, off sets leveled and voids ad/ or damaged sections immediately saturated with water and repaired by filling with water and repaired by filling with concrete or mortar of the same composition as was used in the surfaces. The surfaces shall then be thoroughly wetted and rubbed with carborandum or other abrasive. Cement mortar may be used in the rubbing, but the finished surfaces shall not be brush coated with either cement or grout after rubbing. The finished surfaces shall present a uniform smooth appearance.

Protection :

All concrete shall be protected against damage until final acceptance by Engineer-in-charge.

Foundation Bedding, Bonding and Jointing :

All surfaces upon or against which concrete will be placed shall be suitably prepared by thoroughly cleaning, washing and dewatering as may be indicated in the plans or as Engineer-in-charge may direct to meet the various situations encountered in the work.

Soft or spongy areas shall be cleaned out and back filled with either a soil cement mixture, lean concrete or clean sand fill compacted to minimum density of 90%. Modified proctor, unless otherwise mentioned in schedule of quantities.

Prior to construction of form work for any item where soil will not act as bottom form, approval shall be obtained from Engineer-in-charge as to the suitability of the soil.

Preparation Rock Strata of Foundations :

To provide tight bond with rock foundations, the rock surface shall be prepared and the following general requirements shall be observed.

Concrete shall not be deposited on large sloping rock surface. Where required by Engineer-in-charge or as indicated on the plans, the rock shall be cut to form rough steps or benches to provide roughness or a more suitable bearing surface.

Rock foundation stratum shall be prepared by picking, barring, wedging and similar methods which will leave the rock in an entirely sound and unshattered condition.

Shortly before concrete is placed, the rock surface shall be cleaned with high pressure water and air jet even though it may have been previously cleaned in that manner.

Prior to placing concrete, the rock surface shall be kept wet for a period for 2 to 4 hours unless otherwise directed by the Engineer-in-charge.

Before placing concrete on rock surfaces, all water shall be removed from depressions to permit through inspection and proper bonding of the concrete to the rock.

Preparation of Earth Strata of Foundations :

All earth surfaces upon which additional concrete is to be placed later, shall preferably be done by scarifying and cleaning while the concrete is between its initial and final set. This method shall be used wherever practicable and shall consist of cutting the surface with picks and stiff brooms and by use of an approved combination of air and water jet as directed by Engineer-in-charge. Great care shall be taken in performing this work to avoid removal of too much mortar and the weakening of the surface by loosening of aggregate. When it is not practicable to follow the above method, it will be necessary to employ air tools to remove laitance and roughen the surface.

The final required result shall be pitted surface from which all dirt, unsound concrete, laitance and glazed mortar have been removed.

Bonding Treatment Mortar:

After rock or concrete surfaces upon which new concrete is to be placed have been scarified, cleaned and wetted specified herein, it shall receive a bonding treatment, immediately before placement of the concrete.

The bonding medium shall be a coat of cement sand mortar. The mortar shall have the same cement-sand proportion the concrete which shall be placed on it. The water cement ratio shall be determined by placing conditions and approved by Engineer-in-charge.

Bonding mortar shall be placed in sufficient quantity to completely cover the surface about 10mm thick for rock surface and about 5mm thick for concrete surfaces. It shall be brushed or broomed over the surface and worked thoroughly into all cracks, crevices and depressions. Accumulations puddles of mortar shall not be allowed to settle in depressions and shall be brushed out a satisfactory degree as determined by Engineer-in-charge.

Mortar shall be placed at such a rate that it can be brushed over the surface just in advance of placement of concrete. Only as much area shall be covered with mortar as can be covered with concrete before initial set in the mortar takes place. The amount of mortar that will be permitted to be placed at any one time, or the area which is to cover, shall be in accordance with Engineer-in-charge.

Cleaning and Bonding of formed Construction Joints:

Vertical construction joints shall be cleaned as specified above or by other methods approved by Engineer-in-charge in placing concrete against formed construction joints, the surfaces of the joints, where accessible, shall be coated thoroughly in the specified bed-joint bonding mortar immediately before they are covered with concrete or by scrubbing with wire brooms, dipped in to the fresh concrete. Where it is impracticable to apply such a mortar coating, special precautions will be taken to ensure that the new concrete is brought into intimate contact with the surface of the joint by carefully paddling and spading with aid of vibrators and suitable tools.

Expansion and Contraction:

Provision shall be made for expansion and contraction in concrete by use of special type joints located as shown in the drawings. Construction joint surfaces shall be treated as specified in the specification, shown in the drawings and directed by Engineer-in-charge.

Hot Weather Requirements:

All concrete work performed in hot weather shall be in accordance with IS 56, except as herein modified.

Ad mixtures may be used only when approved by Engineer-in-charge.

Adequate provision shall be made to lower concrete temperatures by cool ingredients, eliminating excessive mixing, preventing exposure of mixers and conveyors to direct sunlight and the use of reflective paint, on mixers etc. The temperature of the freshly placed concrete shall not be permitted to exceed 30C.

Consideration shall be given to shading aggregate stock piles from direct rays of the sun and spraying stock piles in water, use of cold water available and burying, insulation, shading and / or painting white, the pipe line sand water storage tanks and conveyances.

In order to reduce loss of mixing water, the aggregates, wooden forms, sub grade, adjacent concrete and other moisture absorbing surfaces, shall be well wetted prior to concreting, placement and finishing shall be done as quickly as possible.

Extra precautions shall be taken for the protection and curing of concrete. Consideration shall be given to continuous water curing and protection against high temperatures and drying hot wind for a period of atleast 7 days immediately after concrete has set and after which normal curing procedures may be resumed.

Plain Cement Concrete for General Work:

For plain cement concrete work, the specification for materials viz., cement, sand, fine and coarse aggregates and water shall be the same as that specified in reinforced concrete work specification.

But the proportion of mix will be nominal and the ratio of fine and coarse aggregate may be slightly adjusted within limits, keeping the total value of aggregates to a given volumes of cement constant to suit the sieve analysis of both the aggregates. Cement shall on no account be measured by volume, but it shall always be used directly from the bags (i.e. 50kg/ bag)

The proportion of cement, sand, aggregate and water for concrete of proportion 1:5:10, 1:4:8, 1:3:6 & 1:2:4 by volume shall generally consist of quantities as given below :

Proportion of Ingredients	Quantity of material used per bag of cement				
	Cement	Fine aggregate (Sand)	Coarse aggregate	Total of fine and coarse aggregates	Water
1:5:10	1	170 litres	340 litres	800 Kgs	60 litres
1:4:8	1	130 litres	272 litres	625 Kgs	54 litres
1:3:6	1	102 litres	204 litres	480 Kgs	31 litres
1:2:4	1	68 litres	136 litres	350 Kgs	32 litres

The quantity of water used shall be such as to produce concrete of consistency required by the particular class of work and shall be decided by the use of a slump cone. Sufficient care should be taken to see that no excess quantity of water is used. The final proportion of the aggregate and quantity of water shall be decided by the Engineer-in-charge on the basis of test in each case.

The slump shall be specified for each class of work and shall be general be as follows:

Type of Concrete	Max. slump (in mm)
Mass concrete	50
Concrete below water proofing treatment	50
Coping	25
Floor paving	50

All plain concrete should be preferably mixed in a drum type power driven machine with a loading hopper which will permit the accurate measure of various ingredients. If hand mixing is authorized, it should be done on a water tight platform.

The mixing of each batch in the concrete mixer shall continue for not less than 1.5 minutes after the materials and water are in the mixer. The volume is mixed materials per batch shall not exceed the manufacturers rated capacity of the mixer. The mixer shall rotate at a peripheral speed of about 60metres per minute.

Concrete shall be poured and consolidated in its final position within half an hour of mixing. There tempering of concrete which has partially hardened, that is remixing with or without additional cement aggregate or water shall not be permitted. Concrete of mix 1:3:6 and 1:2:4 will be required to be vibrated if specified and directed by the Engineer. In case of the thickness of concrete is more than 150mm, it may be vibrated as directed by the Engineer.

The concrete shall be cured for 10 days in ordinary weather and 15 days in hot weather.

Measurements for the work done shall be exact length, breadth and depth shown in figures on the drawings or as directed by the Engineer and after the concrete is consolidated. NO extra shall be paid for excess quantity resulting from faulty workmanship.

Specific Requirements for concrete and allied works:

The following specific requirements shall be met within addition to those provided in the clause of specification for concrete and allied works:

General :

If so specified in Schedule 'A' for the work, the Engineer-in-charge shall supply with specification for" Concrete and Allied works" and the contractor shall be solely responsible for supplying mixed concrete in accordance with the specification for concrete and allied works and also this specification. The rates for the reinforced concrete work shall be based on the issue rates of cement and steel as given in the schedule "A".

Water:

Clean water in pipes under pressure shall be provided by the contractor with all necessary equipment for giving a nozzle pressure of not less than 2.0 kg/ sq.cm for the convenient and

effective jetting of rock foundations and concrete surfaces, for cooling aggregate required for concrete, for curing concrete and other requirements.

Fire protection System:

The contractor shall provide and maintain at all times in adequate fire protection system to protect his equipment, material and construction. In case of an emergency, the contractor shall permit the Engineer-in-charge to use the system for protecting equipment, works etc. on the project.

Concrete:

The rates for all concrete work should be based as per specifications and taking into consideration the guidelines indicated in special instruction under relevant clause.

The placement Intervals :

Each placement of concrete shall be allowed to set for a period of 48 hours and longer when required before the start of subsequent placement. A time gap between the two adjoining pours in the horizontal plane and the two adjacent pours in the vertical plane shall be 7 days and 3 days respectively.

Encasing Rolled Steel Sections :

General Requirements :

Before concrete work is started , the Engineer – in – charge shall check that all rolled steel sections to be encased, have been erected truly in position. The sections shall be un painted and shall be wire brushed to remove the loose rust / scales etc. Where so specified , ungalvanised metal, having mesh or perforations large enough to permit the free passage of 12.5mm nominal size aggregate through them shall be wrapped round the section to be encased and paid for separately

Wrapping :

In case of columns , the wrapping shall be arranged to pass through the centre of the concrete covering. The wrapping of the entire length of the columns be carried out in stages and no stage shall cover more than 1.5m of height of columns. Successive wrappings shall be carried out only after the immediate adjacent wrapping has been encased in concrete. The surface and the edges of the flanges of the steel columns shall have a concrete cover of not less than 50mm. The wrappings of the successive stages shall be tied together.

In case of beams and grillages, the wire mesh or expanded metal shall be wrapped round the lower flange of the beam and the warpping shall be suspended by wire hangers 5mm diameter placed at about 1.2m centres. The surfaces and edges of the steel sections shall have a concrete cover of not less than 50mm. The wrapping shall pass through the centre of the concrete covering at the edges and soffits of the flanges.

Concreting :

Concrete shall consist of a mix of 1:2:4 (1 cement : 2 coarse sand : 4 graded stone aggregate of 12.5mm nominal size) unless a richer mix is specified. The mix shall be poured solidly around the steel sections and around the wrapping by vibrating the concrete into position. Consistency of concrete, placing of concrete and its compaction , curing , finishing and strength of concrete shall be as described.

All tests shall be conducted in accordance with IS 2386 (Part-I to VIII)

(iii) Change in quality of aggregate as per trade group name shall not be acceptable in the work. Change in source of aggregates shall also not be acceptable under normal circumstances, even if the aggregate belong to the same trade group Engineer-in-Charge may with his discretion allow a change in the source. But, in that case, all test mentioned in above shall have to be repeated for the aggregates form the changed source and the test results submitted to Engineer-in-Charge for his approval before the delivery of material at site

(iv) in addition to above, the following tests have to be performed on representative samples from every lot of aggregate after delivery at site. These test results are to be submitted to the Engineer-in-Charge for his approval. Acceptance criteria for aggregates shall be based or the results of this set of tests only If in the opinion of the Engineer-in-Charge, the test results are not with in permissible limits, the lot of aggregates from which the samples have been obtained for testing shall stand rejected and the material shall be removed from the site.
Mandatory tests on Aggregates at site

Tests	Nos. of test on each 50 cum of material or part thereof
Specific Gravity	3
Bulk Density	3
Aggregate Crushing Strength	3
Limits of deleterious substances	3
Aggregate Impact Value	3

Mean value of the results from above test shall be taken as the representative value and the acceptance criteria shafl be based on these. All test procedures and computations for test results shall be as per IS 2386

(v) All other tests in para iv being in compliance with requirements set in specifications, if only the limits of deleterious substances do not meet the requirements, and attempt may be made to wash the aggregate to bring the limits within permissible values. Under such circumstances, moisture content check shall be made and allowance made before batching

(vi) Apart from mandatory tests specified above, the Engineer-in-Charge may at his discretion call for any additional tests that he may consider necessary. Sampling, procedure and computations for such test shall be done in accordance with IS 2430 and IS 2386 as applicable.

Cement :

Supplier of cement shall furnish the following documents before the cement is delivered to site :

(i) Certificate confirming that chemical composition and physical characteristics are within the stipulated values for types of cement supplied as per relevant codes.

(ii) Certificate confirming that the chloride content in the cement is not in excess of 0.05 percent of mass of cement.

(iii) if during subsequent testing of cement supplied in lots any of the properties are found to be outside the acceptable limits, the lot of cement shall be rejected.

(iv) Each 1000 bags or part thereof the cement or each wagon load of cement shall constitute one lot of cement for the purpose of conducting tests at site before cement is accepted.

(v) Samples for testing at site shall be taken at random from 2% of the total quantity supplied in one lot For cement supplied in bags, samples shall be drawn from minimum of 5 bags and the 2% value shall be rounded off to the next higher integer

For bulk cement, sampling shall be done with the help of slotted sampler to be as per IS 3535

(vi) Results of test conducted on samples drawn shall be submitted to the Engineer-in-Charge for his approval. If in the opinion of the Engineer-in-Charge, the test results are not within permissible limits, the lot of cement from which samples have been obtained from testing shall stand rejected and the material shall be removed from site.

(vii) Following tests shall be conducted at site on each lot of cement delivered:-

Mandatory Tests	Nos. of test per lot
Consistency of standard cement paste	5
Initial and final setting time	5 each
Compressive strength test	10

Mean values of the results from the above results shall be taken as the representative value and the acceptance criteria shall be based on these test All test procedures and computation of test results shall be as per I.S. 4031.

(viii) Apart from mandatory tests specified above, the Engineer-in-Charge may at his discretion, call for any additional tests that he may consider necessary. All such tests shall be done on representative samples taken from each lot and testing and computation of test results shall be done as per IS 4031.

Water :

(i) Water to be used in manufacturing and curing of concrete shall be tested before use. All such test results shall be submitted to the Engineer-in-Charge for his approval before water is used

(i) Manufacturer/ Contractor responsible for curing concrete shall identify and inform the Engineer-in-Charge, precisely the location of source of water intended to be used. Each such source of water shall be separately tested. In the event of a change in the source of water all tests specified herein shall have to be repeated.

(iii) In the event water is drawn from tube wells or open-wells, water samples shall be tested for seasonal fluctuations in water table or at intervals to be directed by the Engineer-in-charge.

(iv) Water sample from each source shall be tested as under:-

Test	Nos. of test for each source
Acidity	3
Alkalinity	3
Presence of solids	3

Mean values of the above test shall be taken as the representative value and the acceptance criteria shall be based on these test results. All testing procedure and computation of test results shall conform to IS 3025.

Admixtures :

(i) Suppliers of Admixtures for concrete shall supply the following before any admixtures is approved by the Engineer -in-Charge for their used-

Certificate confirming that the use of a particular brand of admixture shall not be harmful to concrete in any way.

Certificate confirming the exact dosage of admixture of a particular brand.

Certificate stating the specific purpose for which the admixture is to be used.

Special precautionary measures to be taken in the manufacturer of concrete when using the particular brand of admixture.

Certificate confirming that the admixture conforms to specifications of IS 9103 or to ASTM-C260, ASTM - C10, ASTM - C 595 or to ASTM- C 618.

(ii) Engineer-in-Charge at his discretion may require tests to be performed to reconfirm the characteristic properties of any admixture. All such tests shall be done in accordance with IS: 9103.

(ijj) All tests shall be done at the site laboratory or at a laboratory to be identified by the Engineer-in-Charge depending on the test to be conducted

(iv) All test shall be done in the presence of a representative nominated by the Engineer-in-Charge and a representative of the concrete Manufacturer/ Contractor when tests are performed at the site laboratory. All observation and reports of test shall be jointly signed by the two representatives before the test results are submitted to the Engineer-in-Charge.

(v) Expenses for all materials used for testing, sampling procedures and testing including preparing reports shall be borne by the concrete Manufacturer/ Contractor

(vi) Rate of concrete is inclusive of cost of admixtures. The contractor shall not be paid anything extra for admixtures required for achieving direct workability without any change in specified water cement ration for RCC/CC work.

Sampling and Testing for Quality Control of Fresh Concrete :

Fresh concrete shall be tested for

Slump

Compacting Factor/Workability

Consistency

Weight per cubic metre, cement factor and air content

Slump :

(i) For concrete totally mixed in a central plant, slump shall be checked at :

Immediately during loading of trucks

Point of discharge from the delivery truck

Final placement location

At placement location the slump measured shall conform to the design slump. Manufacturer of concrete shall adjust for loss of slump in transit and establish the requirements of design mix. All slump measurements shall be done within a period of 20 minutes from the time cement is added to the mixer. Placement contractor shall transport concrete from truck discharge point to actual placement location within 10 minutes of delivery, before the final slump reading is taken at placement location.

(ii) For concrete entirely mixed in transit or for shrink mix concrete, slump reading shall be taken at-Point of discharge from delivery trucks

Final placement location

In this case also the slump measured at the final placement location shall conform to the design slump. The placement contractor shall be responsible for transporting concrete from delivery truck discharge point to final placement location within 10 minutes. However, in this case, the truck shall discharge the concrete within 1 hour and 30 minutes from the time cement is added in the mixer and slump measured at point of discharge immediately on delivery. Manufacturer of concrete shall ensure that the final slump measurement corresponds to the ordered slump

(ii) For measuring concrete slump at point of discharge from delivery trucks, samples shall be taken from concrete omitting the first and the last 15% of the load. For concrete delivery of placed by pumping, sampling shall be similar to those specified for delivery trucks.

(iv) Slump measurements of ready mix concrete transported by buckets shall be at locations specified with same limits on time. Sampling from buckets shall be such that the buckets containing discharge from mixer for the last 15% are omitted.

(v) At placement locations, samples for checking slump shall be collected from every 20 cum of concrete or part thereof placed at location for each type of concrete.

(vi) For all slump checks in the field at least two recordings shall be made and the average value taken as the recorded slump.

(vii) Slump checks for concrete in the laboratory shall be carried out as and when required by the manufacturer of concrete during the mix design stage and during the progress of work for control on field, results.

(viii) Slump readings shall only be a guideline for concrete consistency and shall not be taken as the acceptability criteria for concrete placed at location. All slump test shall be carried out in accordance with IS 1199.

Compacting Factor :

(i) For concrete whose ordered slump is 50 mm or less, compacting factor test shall be conducted at both field and central batch plant in addition to slump tests mentioned above.

(ii) Compacting factor check shall be done in field only at placement location, and shall also be conducted at central batch plant if concrete is totally mixed in plant.

(iii) For this test, sampling shall be done as for slump measurements in field and within the same frame as for slump test.

(iv) Only one compaction factor test shall be conducted for every 20 cum of concrete or part thereof placed at location for each type of concrete. Since the test is sensitive, every care shall be taken to conduct this test totally in compliance with procedure mentioned in IS 1199

(v) Laboratory tests for determining compacting factor of concrete shall be done as per manufacturer's requirements for establishing and controlling the design mix of concrete.

(vi) Compacting factor test shall not be taken as an acceptance criteria and shall be treated only as a guideline to workability of concrete.

Consistency of Concrete :

This test shall be performed only at the batching plant laboratory using a Vee-Bee Consistometer, for determining and predicting the slump of concrete. Number and frequency of these tests shall be based on requirements of the manufacturer of concrete. Care shall be taken in producing mix design of required characteristic strengths of concrete within limits of Vee-Bee-Degrees between 1.6 and 4.5 for concrete transported and placed by normal method and between 0.8 and 3.5 for concrete transported and placed by pumping methods.

Weight, Cement Factor and Air contents Test :

Freshly mixed concrete for every type shall be tested in the batch plant laboratory for each batch of concrete produced to determine weight per cubic metre of freshly mixed concrete, cement factor in concrete and the air content of the concrete. Frequency and number of test

shall be finalized by the manufacturer of concrete in consultation with the Engineer-in-Charge for his requirement of the mode of measurement of concrete produced

The Engineer-in-Charge may at his discretion require further tests over and above those specified above to be conducted on fresh concrete. The manufacturer and the placement contractor shall have to comply with all such requirements.

Sampling and Testing for Quality Control of Hardened Concrete :

(i) Test on cube crushing strength of concrete in accordance and compliance with IS 456 and IS 516 shall be done as under: -

Sample of fresh concrete shall be taken from concrete at central batch plant mixer while loading delivery trucks or other transport and also from concrete transported to placement location.

Test on specimens made from samples collected at placement location shall be considered as field test specimens and results therefrom shall be the criterion of concrete strength. Test on specimens made from samples at the batch plant shall only be taken as guideline test. Only in the case of doubtful result, the Engineer-in-Charge may refer to such guideline results for deciding on the quality of concrete.

For truck mix concrete and shrink mix concrete guideline test specimens shall be made from samples collected at discharge location from mixing trucks. For this purpose first and last 15% of the load shall be omitted while collecting samples,

Frequency of sampling shall be as given below in Table 5.8 for each grade of concrete of different workability's and for each type of specimens (field test specimens and guideline test specimens) for conducting 28 days crushing strength tests.

Quantity of concrete Delivered (Cum)	Nos. of samples
Less than 5	1
6 - 15	2
31 - 50	3
51 and above sample for each	4 plus one additional 50 cum or part

Each sample shall be of adequate quantity so that a minimum of 3 specimen cubes can be made test of the sample in accordance with IS 516

(e) All test specimens shall be made compacted cured and tested in compliance with IS 516 and test result interpreted in accordance with IS 456 for acceptance of concrete strength, field specimens test results shall not be less than values given

In addition to 28 day crushing strength test on specimens made at frequencies specified above, early strength tests at 7 days shall also be conducted on field specimens as well as guideline test specimens. Frequency of sampling for this set of test shall also be same as those specified in Table above 7 day strength shall conform to values given in

Table, But these test results even if conforming to specified values shall only be taken a guideline values for projecting concrete strength and shall not be construed as conforming to specifications.

For each grade of concrete and for all workability conditions with different water - cement ratios and compositions of admixtures, preliminary test shall be conducted for crushing strength on finalization to design mix for each type of concrete. Such test shall be conducted both at 7 days and 28 days under laboratory conditions. Six test specimens shall be made for 7 days test and six test specimens shall be made for 28 days test.

Average of the six test results of different periods shall not be less than those specified in Table

(h) Crushing strengths on cubes shall also be conducted during the process of finalization of concrete design mix. Frequency and number of such tests shall be as per Mix of requirements of concrete manufacturer.

(i) All test specimens for conducting crushing strength shall be properly labeled for identification indicating:-

(i) Date of making specimen

(ii) Grade of concrete

(iii) Placement location exact

(iv) Purchasers order number

(j) In addition to crushing strength test on concrete, the Engineer-in-Charge may call for other tests on hardened concrete. The placement contractor and the manufacturer of concrete shall comply with all such instructions.

(ii) Non-destructive Tests

(a) When the 28 days crushing values on field specimens and/ or specimens and/or specimens made for guideline test fail short of specified values, or in case of doubtful placement of concrete, the Engineer-in-Charge shall call for non-destruction tests on the structure. Such tests may be any one or a combination of the following :-

Rebound hammer test

Windsor Penetration Probe test

Pulse velocity (sonic or Ultrasonic) test

Core test

Load test

Interpretation of rebound hammer, Windsor Probe and Pulse velocity test results shall rest with the Engineer-in-Charge,

Core test, if ordered by the Engineer-in-Charge, shall be done in accordance with IS 516. Samples for such test shall be taken from locations to be identified by the Engineer-in-Charge and such samples shall be collected in compliance with IS: 1199.

If felt necessary, the Engineer -in-Charge may instruct load testing for any part of the structure based on doubtful concrete strengths. Such test shall be carried out as per details to be provided by the Engineer-in-Charge in consultation with the structural consultants.

The concrete manufacturer/ concrete placement contractor shall arrange for all test to be conducted in accordance with these specifications, including all necessary tools, plants, equipment and material and shall be responsible for conducting all test at his cost.

All test conducted at the filed laboratory shall be carried out by qualified technicians employed by the concrete manufacturer/ concrete placement contractor, in presence of authorized representative of the Engineer-in-Charge. AH test reports and observation reports shall be jointly signed by the Engineer-in-Charge authorized representative and the technician conducting such test.

Engineer-in -Charge shall alone decide where such tests are to be conducted. He may instruct tests to be conducted at laboratories other than the field laboratory and such instructions shall be followed without claiming extra charges on this account.

(h) The Concrete Manufacturer/ Placement contractor shall set up a laboratory at this own expense which shall have facilities, for conducting all necessary field test on materials and field and laboratory test on concrete. The laboratory shall be staffed by the concrete Manufacturer/ Placement Contractor with qualified and experienced scientists and technicians.

Finishing of Concrete :

General :

Unless otherwise specified, concrete finishes shall conform to the following specification :

Finish F1, F2 and F3 shall describe formed surface
Finish U1, U2 and U3 shall describe un-formed surface.

Off sets or fins caused by disposed or misplaced form sheathing lining or form sections or by defective form lumber shall be referred to as abrupt irregularities. All other irregularities shall be referred to as gradual irregularities. Gradual irregularities shall be measured as deviation from a plain surface with a template 1.5 m long for formed surface and 3 m long for unformed surfaces.

Formed surfaces :

Finish F1 :

Shall apply to all formed surfaces for which finish F2,F3 or any other special finish is not specified and shall include filling up all form tie holes.

Finish F2 :

Shall apply to all formed surfaces so shown on the drawings or specified by the Engineer-in-charge. This shall include filling all form tie-holes, repair of gradual irregularities exceeding 6mm, removal of ridges and abrupt irregularities by grinding.

Finish F3 :

Shall apply to all formed surfaces exposed to view or where shown in the drawing or specified by the Engineer-in-charge. Finish F3- shall include all measures specified for finish F2 and in addition, filling air holes with mortar and treatment of the entire surface with sack rubbed finish. It shall also include clean up of loose and adhering debris. Where a sack rubbed finish is specified, the surfaces shall be prepared within two days after removal of the forms.

The surface shall be wetted and allowed to dry slightly before mortar is applied by sack rubbing. The mortar used shall consist of one part cement to one and half parts by volume of fine (minus n0.16mesh) sand. Only sufficient mixing water to give the mortar's workable consistency shall be used. The mortar shall then be rubbed over the surface with a fine burlap or linen cloth so as to fill all the surface voids. The mortar rubbed in the voids shall be allowed to stiffen and solidify after which the whole surface shall be wiped clean so that the surface presents a uniform appearance without air hole, irregularities etc.

Curing of the surface shall be continued for a period of 10 (ten) days..

Unformed Surfaces :

Finish U 1 :

Shall apply to all unformed surfaces for which the finish U2, U3 or any other special finish is not specified and shall include screeding the surface for the concrete to the required slope and grade. Unless the drawing specified a horizontal surface or shown the slope required, the tops of narrow surfaces such as stair, treads, walls, curbs, and parapets shall be sloped approximately 10mm per 300mm width. Surfaces to be covered by backfill or concrete sub-floors to be covered with concrete topping, terrazzo and similar surfaces shall be smooth screened and leveled to produce even surface, irregularities not exceeding.

Finish U2 :

Shall apply to all unformed surfaces as shown in the drawing or specified by the Engineer-in-charge and shall include screeding and applying a wood float finish to the surface of the concrete to the required slopes and grade.

Repair of abrupt irregularities unless a roughened texture is specified. Repair of gradual irregularities exceeding 6mm.

Finish U3 :

Shall apply to unformed surfaces for which a high degree of surface smoothness is required, where shown on the drawing or specified by the Engineer-in-charge. This shall include screeding, floating and applying a steel trowel finish to the surface of the concrete to the

required slopes and grade. Repair of gradual irregularities exceeding 6mm, finishing joints and edges of concrete with edging tools.

Mode of Measurement for concrete work:

General :

Concrete as actually done shall be measured for payment, subject to the following tolerances, unless otherwise stated hereinafter. Any work done extra over the specified dimensions shall not be measured for payment.

Linear dimensions shall be measured in full centimeters except for the thickness of slab which shall be measured to the nearest half centimeter.

Areas shall be worked out to the nearest 0.01 sqm.

Cubic contents shall be worked out to the nearest 0.001 cum.

The concrete shall be measured for its length, breadth and height/depth limiting dimensions to those specified on drawings or as directed by the Engineer-in-charge.

Note : The size of RCC members as assumed in to estimate are based on preliminary drawings and are likely to be changed. The contractor is not entitled to any extra claim due to such changes.

Deductions :

No deduction shall be made for the following :

- a. Ends of dissimilar materials e.g. joists, beams, posts, girders, rafters, purlins, trusses, corbels, steps etc. upto 500 sq.cm in cross section.
- b. Opening upto 0.1 sqm. (1000 sq.cm)
- c. Volume occupied by reinforcement.
- d. Volume occupied by pipes, conduits, sheathing etc. not exceeding 100sq.cm. each in crosssectional area. Nothing extra shall be paid for leaving and finishing such cavities and holes.

Coping Beam:

Beam shall be measured from face to face of the columns, walls, cross beams including haunches if any. The depth of the beams shall be measured from the top to the bottom of the beam. The beams with narrow width even though acting as fascia in elevation in some cases will be measured as beams only.

6. STEEL REINFORCEMENT

Steel reinforcement bars, if supplied or arranged by contractor, shall be either plain round mild steel bars grade as per IS 432 (part-I) or medium tensile steel bars as per IS 452 (part-I) or hot rolled mild steel and medium tensile steel deformed bars as per IS 1139 or cold twisted steel bars and high yield strength deformed bars as per IS 1786, as shown and specified on the drawings. Wire mesh or fabric shall be in accordance with IS 1566. Substitution of reinforcement will not be permitted except upon written approval from Engineer-in-charge.

Storage :

The reinforcement steel shall not be kept in direct contact with ground but stacked on top of and arrangement of timber sleepers or the like. Reinforcement steel shall be with cement wash before stacking to prevent scale and rust. Fabricated reinforcement shall be carefully stock to prevent damage, distortion, corrosion and deteriorations.

Quality :

All steel shall be grade I quality unless specifically permitted by the Engineer-in-charge. No rolled material will be accepted. If demanded by the Engineer-in-charge. Contractor shall submit the manufacturers test certificate for steel. Random tests on steel supplied by contractor may be performed by Engineer-in-charge as per relevant Indian Standards. All costs incidental to such tests shall be at contractors expense. Steel not conforming to specifications shall be rejected. All reinforcement shall be clean, free from grease, oil, paint, dirt loose mill, scale dust, bituminous materials or any other substances that will destroy or reduce the bond. All rods shall be thoroughly cleaned before being fabricated. Pitted and defective rods shall not be used. All bars shall be rigidly held in position before concreting. No welding of rods to obtain continuity shall be allowed unless approved by the Engineer-in-charge. If welding is approved, the work shall be carried as per 2751, according to best modern practices and as directed by the Engineer-in-charge in all cases of important connections, tests shall be made to prove that the joints are of the full strength of bars welded. Special specifications, as specified by the Engineer-in-charge, shall be adhered to in the welding of cold worked reinforcing bars and bars other than mild steel.

Laps :

Laps and splices for reinforcement shall be shown in the drawings. Splices, in adjacent bars shall be staggered and the locations of all splices, except those specified on the drawing shall be approved by the Engineer-in-charge. The bars shall not be lapped unless the length required exceeds the maximum available length of bars at site.

Bending :

All bars shall be accurately bent according to the sizes and shapes shown on the detailed working drawings/ bar being schedules. They shall be bent gradually by machine or other approved means. Reinforcing bars shall not be straightened and rebent in a manner that will injure the materials. Bars containing cracks or splits shall be rejected. They shall be bent cold, except bars of over 25mm in diameter which may be bent hot if specifically approved by the Engineer-in-charge. Bars bent hot shall not be heated beyond cherry red colour (not exceeding 6450 C) and after bending shall be allowed to cool slowly without quenching. Bars incorrectly bent shall be used only of ht means used for straightening and rebinding be such as shall not, in the opinion of the Engineer-in-charge injure the material. No reinforcement bar shall be bent when in position in the work without approval, whether or not it is partially embedded in hardened concrete. Bars having links or bends other than those required by design shall not be used.

Bending at Construction Joints :

Where reinforcement bars are bent aside at construction joints and afterwards bent back into their original position, care should be taken to ensure that no time the radius of the bend is less than 4 bar diameters for plain mild steel or 6 bar diameters for deformed bars. Care shall also be taken when bending back bars to ensure that the concrete around the bar is not damaged.

Fixing / Placing and Tolerance on Placing :

Reinforcement shall be accurately fixed by any approved means maintain distance the correct position as shown in the drawings by the use of blocks, spacer and chairs as per IS 2502 to prevent displacement during placing and compaction of concrete. Bar intended to be in contact at crossing point shall be securely bound together at all such points with two strands of (0.9 to 1.6mm dia binding Wire) number 16 gauge and 18 gauge annealed soft iron wire. The heavy reinforcement bars shall tied with thicker dia wire. The vertical distances required between successive layers of bars in beams or similar members shall be maintained by the provision of mild steel spacer bars at such intervals that the main bars do not perceptibly sag between adjacent spacer bars.

Tolerance on placing of reinforcement :

Unless otherwise specified by the Engineer-in-charge, reinforcement shall be placed within the following tolerances :

Tolerance in spacing

- | | |
|--|---------|
| a. For effective depth, 200 mm or less | + 10 mm |
| b. For effective depth, more than 200 mm | + 15 mm |

Cover to Reinforcement :

The cover shall in no case be reduced by more than one third of specified cover or 5mm whichever is less. Unless indicated otherwise on the drawings, clear concrete cover for reinforcement (exclusive of plaster or other decorative finish shall be as follows) :

- a. At each end of reinforcing bar not less than 25 mm, nor less than twice the diameter of such bar.
- b. For a longitudinal reinforcing bar not less than 25 mm, nor more than 40 mm, nor less than the diameter of such bar. In the case of column of maximum dimensions of 200mm or under, whose reinforcing bars do not exceed 12mm, a cover of 25mm may be used.
- c. For longitudinal reinforcing bar in a bar, not less than 25 mm nor less than the diameter of such bar and.
- d. For tensile, compressive, shear, or other reinforcement in a slab, not less than 25mm, nor less than the diameter of such bar and.
- e. For any other reinforcement not less than 15mm, nor less than the diameter of such bar.
- f. Increased cover thickness may be provided when surfaces of concrete members are exposed to the action of harmful chemicals (as in the case of concrete in contact with earth faces contaminated with such chemicals), acid, vapour, saline, railways) etc. and such increase of cover may be between 15mm and 50 mm beyond the figures given in (a to e) above as may be specified by the Engineer-in-charge.

g. For reinforced concrete members, totally immersed in sea water the cover shall be 40mm, more than specified (a to e) above.

h. For reinforced concrete members, periodically immersed in sea water or subject to sea spray, the cover of concrete shall be 50 mm more than that specified (a to e) above.

i. For concrete of grade M25 and above, the additional thickness of cover specified in (f), (g) and (h) above may be reduced to half. In all such cases the cover should not exceed 75mm.

j. Protection to reinforcement in case of concrete exposed to harmful surroundings may also be given by providing a dense impermeable concrete with approved protective coating as specified on the drawings. In such case, the extra cover, mentioned in (h) and (i) above, may be reduced by the Engineer-in-charge, to those shown on the drawing.

k. The correct cover shall be maintained by cement mortar briquettes or other approved means. Reinforcement for footings, grade beams and slabs on sub grade shall be supported on precise concrete blocks as approved by the Engineer-in-charge. The use of pebbles or stones shall be permitted.

l. The minimum clear distance between reinforcing bars shall be in accordance with IS 456 or as shown in drawings.

The Bars shall be kept in correct position by the following methods:

a) In case of beam and slab construction precast cover blocks in cement mortar 1:2 (1 cement : 2 coarse sand) about 4X4 cm section and of thickness equal to the specified cover shall be placed between the bars and shuttering, so as to secure and maintain the requisite cover of concrete over reinforcement.

b) In case of cantilevered and doubly reinforced beams or slabs, the vertical distance between the horizontal bars shall be maintained by introducing chairs, spacers or support bars of steel at 1.0 metre or at shorter spacing to avoid sagging.

c) In case of columns and walls, the vertical bars shall be kept in position by means of timber templates with slots accurately cut in them or with block of cement mortar 1:2 (1 cement : 2 coarse sand) of required size suitably tied to the reinforcement to ensure that they are in correct position during concreting,

d) In case of other RCC structure such as arches, domes, shells, storage tanks etc. a combination of cover blocks, spacers and templates shall be used as directed by Engineer-in-charge.

Inspection :

Erected and secured reinforcement shall be inspected and approved by Engineer-in-charge prior to placement of concrete.

Mode of Measurement for reinforcement for R.C.C Works :

Reinforcement as detailed in schedule of quantities shall be measured for payment linearly as per net cutting length nearest to a centimeter shown in bar bending schedule submitted by the contractor and approved by the Engineer-in-charge and weight calculated based on the standard weights as per I.S.S. per meter length. No allowance shall be measured. The cost of steel used by the contractor in the reinforcement only upto the extent shown in the drawings. As far as possible, laps in bars shall be avoided. Any laps and hooks provided by the

contractor other than authorized as per approved bar bending schedule will be considered to have been provided by the contractor for his own convenience and shall not be measured for payment. Pins, chairs, spaces shall be provided by the contractor wherever required as per drawing and bar bending schedule and as directed by the Engineer-in-charge and shall be measured for payment. Fan hooks as required shall be provided by the contractor under this item and shall be measured for payment.

The rate shall include the cost of all materials and labour required for all above operation including transport, wastage, straightening, cutting, bending, binding and the binding wire required.

7. STRUCTURAL STEEL WORK

GENERAL:

This specification covers the supply, fabrication, transportation to site and erection on prepared foundations, structural steel work consisting of beams, columns vertical trusses, bracings, shear connections etc.

Fabrication, erection and approval of steel structures shall be in compliance with:

These general specifications , IS 800-1984, drawings and supplementary drawings to be supplied to the contractors during execution of the work.

Providing shop primer coat for steel structures. Grouting to the complete satisfaction of the Engineer-in-charge.

FABRICATION DRAWINGS:

The contractor shall prepare all fabrication and erection drawings, bill of quantities, schedule of bolts and nuts and as build drawings on the basis of design drawings supplied to him and submit six copies to the Architects/Consulting Engineers for review, the Architect/Engineer shall review and comment, if any of the same. Such review, if any, by the Architects/Engineers does not relieve the contractor of any of his required guarantees/responsibilities. The contractor shall however be responsible to fabricate the structural strictly conforming to specifications and revised drawings.

Fabrication drawings shall include the following:

- Full length layout with all connecting member sizes and blown-up details required for the correct fabrication of the structure
- Types and dimensions of welds and bolts ie., in bolted connections, the bolt dia., the hole dia., the actual location of holes and the coordinating scheme with connecting/ matching elements shall be clearly indicated. As far as possible, uniformity in the bolt dia shall be maintained. Where HSFG bolts are used, method of surface preparation shall be indicated. In case of welded constructions, the size and length of welds along the relevant weld lines should be distinctly marked.
- Detailing of structural steel members subjected to dynamic loading shall be so as to keep the stress concentration to a minimum. Cross welding shall be avoided as far as practicable.
- For bolted connections subjected to dynamic loading, lock nuts or spring washers shall be used in addition to plain washers.
- Details of shop and filled joints included in assemblies.
- The erection clearances for cleat-connected ends of members connecting steel to steel shall preferably not be greater than 10 mm. at each end. The erection clearance at ends of beams shall not be more than 20mm. at each end but where for particular reasons greater clearance is necessary, suitably designed seats shall be provided.
- The fabrication drawings shall be prepared in such a manner that structures are dispatched with maximum transportable lengths and work involved at site is minimum. Steelwork shall be shop fitted and shop- assembled as far as practicable.
- All edge preparations for welding shall conform to IS:9595.
- Adequacy of connections including splice joints, bolt sizes, weld size / length and correctness and completeness of all other details like cutting length of individual items, gusset / cleat size, matching of holes , dimensions of individual items, matching of markings, bill of materials, bolt-list etc. , shall be the sole responsibility of the Contractor.

BILL OF MATERIALS:

Good Quality of structural steels, welding electrodes, bolts, nuts and washers etc. are to be used.

Erection assemblies, identifying all transportable parts and sub-assemblies, associated with special erection instructions if required.

Calculations, 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 same it shall be submitted for approval.

Any alternate design or in section is allowed when approved in writing by Architects.

However, if any variation in the scheme is found necessary later, the contractor will be supplied with revised drawings. The contractors shall incorporate these changes in his drawings at no extra cost and resubmit for review.

Architects/consultants review shall not absolve the contractor of his responsibility for the correctness of dimension, 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 six copies of amended drawings shall be submitted by the contractor for final approval.

The contractor shall supply three prints each of the final approved drawings to the architects within a week since final review, at no extra cost for reference and records.

The architects will verify the correct interpretation of their requirements.

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.

MATERIALS:

All steel and other materials used for steelwork and in association with steelwork shall conform to appropriate Indian standards. Only tested materials shall be used unless written authority is obtained for the use of untested materials for certain secondary structural members. Unless otherwise specified in the drawings

All rolled sections and plates up to & including 20 mm thickness shall conform to Grade "A" as per IS : 2062.

Plates of thickness above 20 mm and Plated structures subjected to dynamic loading shall conform to Grade "B" as per IS: 2062.

For High Tensile steel requirements, material conforming to IS:8500 or SAIL- MA (HYA or HYB) shall be used.

Steel sheets shall conform to IS : 1079.

Steel tubes for structural purpose shall conform to IS : 1161 (of Grade Yst 240)

Corrugated Galvanised Steel Sheets shall conform to IS:277 with appropriate Zinc coating for the selected thickness of sheet on roof and sides.

Aluminium industrial toughed sheets conforming to IS : 1254 shall be used as follows :
In roof - 0.91mm thick
In side walls - 0.71mm thick

Translucent sheets shall be fibreglass reinforced polyester sheets of matching profile as per IS:12866.

Colour coated troughed sheets shall be as per appropriate standard.

Gutters shall be of copper bearing steel conforming to Grade "A" as per IS :2062.

Crane Rails shall conform to IS : 3443.

All black bolts, nuts and locknuts shall conform to IS : 1363 and IS : 1364 (for precision and semi precision hexagonal bolts) of property class 4.6 unless otherwise specified. Washers shall conform to IS : 6610

All tapered washer shall be as per IS:5372 for channels, and IS:5374 for Joists. Spring washers shall conform to IS:3063.

All HSFG bolts shall conform to IS : 3757. Assembly of joints using HSFG bolts shall conform to IS : 4000. Nuts and washers for HSFG bolts shall be as per IS:6623 & IS:6649 respectively.

All materials shall be straight and if necessary before being worked shall be straightened and / or flattened by pressure including de-coiling of plates unless required to be of curvilinear form and shall be free from twists.

1. The MS / GI gratings shall be electro-forged and shall be of approved brand and manufacturer unless otherwise agreed to by the Owner. The type of grating selected shall be based on the loading in the area in which the grating is provided and shall be subject to approval of Owner.

WELDING ELECTRODES:

Welding electrodes shall conform to IS: 814. Approval of welding procedures shall be as per IS: 823.

BOLTS, NUTS AND WASHERS:

Bolts and nuts shall be as per IS: 1367 and tested as per IS: 1608. It shall have a minimum tensile strength of 44 kg/sqmm and minimum elongation of 23% on a gauge length of 5.6 mm (an original cross sectional area of the gauge length). Washers shall be as per IS: 2016.

All materials shall conform to their respective specifications. The use of equivalent or higher grades or alternate materials will be considered only in very special cases subject to the approval of the engineer-in-charge in writing.

RECEIPT AND STORING OF MATERIALS:

Steel materials supplied by the contractor must be marked for identification and each lot should be accompanied by manufacturers quality certificate, conforming chemical analysis and mechanical characteristics.

All steel parts furnished and supplied shall be checked, sorted out, straightened and arranged by grades and qualities in stores.

Structurals 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 Engineer.

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. Electrodes shall be perfectly dry and drawn from an electrode even, if required.

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 the design specification only with the written approval of the Engineer.

MATERIAL TESTS:

The contractor shall be required to produce manufacturer's quality certificates for materials supplied by the contractor. Notwithstanding the manufacturer's certificates, the Engineer may ask for testing of materials in approved test houses. The test results shall satisfy the requirements of the relevant Indian standards.

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 at no extra cost.

Materials for which test certificates are not available or for which test results do not tally with the relevant standards specifications, shall not be used.

FABRICATION:

Fabrication shall be accordance with IS: 800 section V in addition to the following:

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 drawing. The work shall also include fabricating built up sections.

Any defective material used shall be replaced by the contractor at his own expenses, care being taken to prevent any damage to the structure during removal.

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.

Any faulty fabrication pointed out at any stage of work shall be made good by the contractor at his own cost.

PREPARATION OF MATERIALS:

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.

Minor warping, corrugations etc. in rolled sections shall be rectified by cold working.

The sections shall be straightened by hot working where the architects so direct and shall be cooled slowly after straightening.

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).

Surface of members that are to be joined by lap or fillet welding or bolting shall be even so that there is no gap between overlapping surfaces.

Cut edges shall be finished smooth by grinding or machining wherever necessary. Sufficient allowance (3 mm to 5 mm) should be kept in the items in case machining is necessary.

Cutting may be effected by gas cutting, shearing, cropping or sawing. In gas cutting of high tensile steel, special care is to be taken to leave sufficient metal to be removed by machining so that all metal that has been hardened by flame is removed.

Straightening and bending shall be done in cold condition as far as practicable.

If required, straightening and bending may be done by application of heat between 900°C and 1100°C. Cooling down of the heated item shall be done slowly.

MAKING:

Making of members shall be made on horizontal pads of appropriate racks or supports in order to ensure horizontal and straight placement of such members.

Making accuracy shall be at least + or - 1 mm.

CUTTING:

Members shall be cut mechanically (by saw or shear) or by oxyacetylene flame.

All sharp, rough or broken edges, and all edges of joints which are subjected to tensile or oscillating stresses, shall be ground.

No electric metal arc cutting shall be allowed.

All edges cut by oxyacetylene shall be cleaned off impurities prior to assembly.

Cutting tolerance shall be as follows: -

- a) For members connected at both ends + or -1 mm.
- b) Elsewhere + or -3 mm.

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.

Edge preparation shall be as per IS: 823.

DRILLING:

Bolt holes shall be drilled.

Drillings shall be made to the diameter specified in drawings.

No enlarging of holes by filing, by hand drilling or by oxyacetylene flame shall be allowed.

Allowed variations for holes (out of roundness, eccentricity plumb line deviation) shall be as per IS: 800.

- Maximum deviation for spacing of two holes on the same axis shall be +or -1 mm.

- Two perpendicular diameters of any oval hole shall not differ by any more than 1mm.

Drilling faults in holes may be rectified by reaming holes to the next upper diameter, provided that spacing of new hole centres and distances 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. Whole reaming shall be allowed if the number of faulty holes does not exceed 15% of the total number of holes for one joint.

PREPARATION OF MEMBERS FOR WELDING:

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

Sharp edges, rust of cut edges, notches, irregularities 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 beveling 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 into the gaps between members to be welded.

Before assembly the edges to be welded as well as an 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 architects or their authorised representative before assembly.

The permissible tolerance for assembly of members preparatory to welding shall be as per IS: 823-1964. After the assembly has been checked, temporary tack welding in position shall be done by electric welding keeping in view finished dimension of the structure.

WELDING PROCEDURE:

Welding shall be carried out only by full trained and experienced welders as tested and approved by the architects. Any test carried out either by the architects 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.

The steel structures shall be automatically semi automatically or manually welded.

Welding shall begin only after the checks mentioned under preparation of materials, marking, cutting, drilling and preparation of members for welding have been carried out and Welding procedures and tests for welder's skill have been conducted as per IS : 823 and approved by the engineer-in-charge.

The welder shall mark with his identification on each element welded by him.

When welding is carried out on open air, steps shall be taken to protect the place of welding against wind or rain. The electrodes wire and parts being welded shall be dry.

Before beginning the welding operation, each joining shall be checked to assure the parts to be welded are clean and root gaps provided as per IS : 823.

For continuing the welding of seams discontinued due to some reason, the end of the discontinued seam shall be melted in order to obtain a good continuity. Before resuming the welding operation, the groove as well as the adjacent parts shall be well cleaned for a length of approximately 50 mm.

For single butt welds (in V, 1/2 V or U) and double butt welds (in K, double U etc.) the rewelding of the root is mandatory but only the metal deposit of the root has been cleaned by back gauging 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 multilayer welding, before welding the following layer, the formerly welded layer shall be cleaned metal bright by light chipping and wire brushing. Packing 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 defect in welds must be rectified according to IS 823 and as per instruction of Engineer.

WELD INSPECTION:

The weld seams shall satisfy the following:

- shall correspond to design shapes and dimension.
- 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 operations and approval of finished elements, inspections and tests shall be made as shown in Annexure B.

The mechanical characteristics of the welded joints shall be as in IS: 823.

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 assemblies, the members shall be checked and got approved by the Engineer.

The difference in thickness of the sections that are but 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 or 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.

BOLTING UP :

Final bolting of the members shall be done after the defects have been rectified and approval of the joints obtained.

The bolts shall be tightened starting from the centre of joint towards the edge.

PLANING 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 edges shall be removed with grinding machine or files.

The following tolerance shall be permitted on member that has been planed:

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

Level differences of planed surface, maximum 0.3 mm deviation between planed surface and member's axis maximum 1/1500.

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 architects.

For bolted steel structures, trial assembly in shop is mandatory.

The tolerance for spacing of holes shall be + or - 1 mm.

TOLERANCES :

All tolerances regarding dimensions, geometrical shapes and sections of steel structures shall be as per IS 1852, IS 7215 and IS 808.

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 bundle while the crates shall be marked directly.

Each bundle or crate shall be packed with members for one and same assembly, in the same bundle or crate general utility members such as bolts, gussets etc. may be packed.

All bills of materials showing weight, quality and dimensions of contents shall be placed in the crates.

The members shall be marked with a durable paint, in 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 out bordered with white paint.

The marking and job symbol shall be registered in all shop delivery documents (transportation, for erection etc.).

SHOP TEST PRE - ASSEMBLY :

For steel structures that have the same type of welding the shop test pre-assembly shall be performed on one cut 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 'holes for field joints'.

SHOP INSPECTION AND APPROVAL :

GENERAL :

The architects or their representative 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 architects is mandatory.

The contractor shall not limit the number and kinds of tests, final as well as intermediate once, or extra tests required by the architects.

The contractor shall furnish necessary tools, gauges, instruments etc. And technical and non-technical personnel for shop tests by the architects, free of cost.

SHOP ACCEPTANCE :

The architects shall inspect and approve at the following stages

The following approval may be given in shop.

- Immediate approval of work that cannot be inspected later.
- Partial approvals.
- Final approval.

Intermediate approval of work shall be given when a part of the work is performed later.

- Cannot be inspected later.
- Inspection would be difficult to perform and results would not be satisfactory.

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 filed joints
- Approval of parts with planed surfaces.
- Test erection.
- Approval of members.
- Approval of markings.

Inspection and approvals of special features like rollers, loading, platform mechanism etc.

During the partial approval, intermediate approvals as well as all former approvals, shall be taken into consideration.

FINAL APPROVAL IN THE SHOP :

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 stores.

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).

PAINTING AND DELIVERY :

PREPARATION OF PARTS FOR SHOP PAINTING :

Painting shall consist of providing one coat of red oxide zinc chromate primer to steel members before despatch from shop. Final painting is not covered in this contract unless otherwise specified.

Primer coat shall not be applied unless :

- a) Surface have been wire brushed, cleaned of dust oil, rust, etc;
- b) Erection gap between members, spots that cannot be painted or where moisture of other aggressive agents may penetrate have been filled with approved type of oil and putty.
- c) The surfaces to be painted are completely dry.
- d) 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).
- e) Members and parts have been inspected and accepted.
- f) Welds have been accepted.
- g) The following are not to be painted or protected by any other product :
- h) Surfaces which are in vicinity of joints to be welded at site.
- i) Surfaces bearing markings.
- j) Other surfaces indicated in the design.
- k) The following shall be given a coat of hot oil or any approved resistant lubricant only.
 - l) Planned surfaces.
 - m) Holes for links.
- n) The surfaces that are to be embedded or in contact with the concrete shall be given a coat of cement wash.
- o) The surfaces which are in contact with the ground, gravel or brickwork and subject to moisture, shall be given bituminous coat.
- p) The other surfaces shall be given a primer coating.
- q) 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 inaccessible box type sections shall be hermetically sealed by welds.

If specified elsewhere in the schedule of quantities the contractor shall paint further course of red oxide after erection and placing in position of the steel structures.

PACKING, TRANSPORTATION, DELIVERY :

After final shop acceptance and marking, the items 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 item against warping.

Slender projecting parts shall be braced with additional steel bars, before loading, for protecting 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 architects.

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, plates gussets 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 architects and shall be accompanied by document showing :

- Quality and quantity of structure or members.
- Position of members in the structure.
- Particulars of structure.
- Identification number/job symbol.

FIELD ERECTION :

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.

The contractor shall satisfy himself about the levels, alignment etc. for the foundations well in advance, before starting the erection. Minor corrections shall be carried out by the contractor on his own expense.

Any faulty erection done by the contractor shall be made good at his own cost.

Approval by the architects or their representatives at any stages of work does not relieve the contractor of any of his required guarantees of the contract.

STORAGE AND PREPARATION OF PARTS PRIOR TO ERECTION :

The storage place for steel parts shall be prepared in advance and got approved by the architects before the steel structures start arriving from the shop.

Platform shall be provided by the contractor near the erection site for preliminary erection work.

The contractor shall make the following verifications upto receipt of material at site:-

For quality certificates regarding materials and workmanship according to these general specifications and drawings.

Whether parts received are complete without defects due to transportation loading and unloading defects, if any are well within the admissible limit.

For the above work sufficient space must be allotted in the storage area.

Steps shall be taken to prevent warping of items during unloading.

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 the 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.

ERECTION AND TOLERANCES :

Erection in general shall be carried out as required and approved by architects

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 complete satisfaction of the architects.

The following checks and inspection shall be carried out before, during and after erection.

- Damage during transportation.
- Accuracy of alignment of structure
- Erection according to drawings & specifications
- Progress and workmanship.

In case there are any deviations regarding positions of foundations or anchor bolts, which would lead to erection deviations, the architects shall be informed immediately. Minor rectifications in foundations, orientation of bolts holes etc. Shall be carried out as a 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.

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 architects.

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.

FINAL ACCEPTANCE AND HANDING OVER THE STRUCTURE :

At acceptance, the contractor shall submit the following documents

- Shop and erection drawings either in tracings or reproducible.
- 4 copies of each of the following :

Shop acceptance documents

Quality certificate for structural, plates, etc.

(Electrodes, welding wire, bolts, nuts, washers etc.)

List of certified welders who worked on erection of structures.

Acceptance and intermediate control procedure of erection operation.

Approval by the architect at any stage of work does not relieve the contractor of any of his required guarantees of contract.

METHOD OF PAYMENT :

Payment for steel work shall be made on basis of admissible weight of the structure accepted, the weight being determined as described below :-

The rate for supply, fabrication and erection shall include cost of all handling and transportation to owner's store/site of work where supply and fabrication only are involved, trimming, straightening, edge preparation, preparation and getting reviewed of fabrication drawings and providing one coat of red oxide zinc chromate primer.

In case, owner supplies materials, the rate shall include the cost of steel materials, taking delivery of the materials from owner's store, all handling rehandling, loading and unloading, transport to site of work, returning of surplus materials to owner's stores etc. complete as well as the cost of all handling and transport, scaffolding, temporary supports, tools and tackles, touching up primer coat, grouting etc.

The weight for payment will be assessed from the approved fabrication drawings and the respective bill of material prepared by the contractor and approved by the architects. The weight of structural materials/plate shall be calculated on the basis of Standard Weights specified in the IS handbook. If sections are different from IS section, then manufacturers handbook shall be adopted. No allowance in weights shall be made for rolling tolerance.

Sections built out of plates shall be paid on the actual weight incorporated except for gussets which will be paid on the weight of the smallest rectangle enclosing the shape. No deductions shall be made for skew cuts in rolled steel sections.

Welds, bolts, nuts, washers etc. shall not be measured. Rates for structural steel work shall be deemed to include the same.

No other payment either for temporary works connected with this contract or for any other item such as welds, shims, racing plates, etc. shall be made. Such item shall be deemed to have been allowed for in the rate quoted for steel work.

Tolerances allowed in the erection of plant building

Without Cranes :-

The maximum tolerances for line and level of the steel work shall be + or - 3.00 mm on any part of the structure. The structure shall not be out of plumb more than 3.5 mm on each 10 m section of height and not more than 7.00 mm per 30 m section.

The tolerances shall apply to all parts of the structure unless the drawings issued for erection purposes state otherwise.

ANNEXURE - A			
Inspection or Test	Coverage	Procedure	Evaluation findings & remedy of defect
Inspection of Weld Seam	All Welds	Naked Eye or Lens	All faulty welds shall be
Checking of sizes	At least one for each weld	Ordinary measuring instruments (rule, templates)	Should faulty weld be found all welds shall be checked and defects shall be rectified
Mechanical tests for welding procedure, performance & electrodes	-----	As per IS 823	As per IS 823

ANNEXURE - B				
INADMISSIBLE WELD DEFECTS AND TOLERANCE ALLOWED FOR WELDS				
DEFECTS	DETAILING OF SKETCHING DEFECT	ALLOWED TOLERANCES & REMEDY OF DEFECTS	CAUSE OF DEFECTS	MODE OF FINDING DEFECTS
Unsatisfactory appearance	Uneven width rugged seam	At discretion cut weld and re-weld	Uneven welding progress, voltage fluctuations, varying arc length, negligence, inexperienced welder	Extrenal (visual) inspection
Unsatisfactory shape	Hollow or jutting welds	No variance from design shape shall be allowed	negligence	Visual inspection Template checking
Incomplete Weld	-----	Not allowed fill in weld	-----	Template checking
Molten Metal flow	-----	Not allowed fill in weld	Excessive melting wrong handling of electrodes.	Visual Inspection
Pits	-----	Not allowed Cut and Re-weld	Wrong welding technique	Visual Inspection
Surface Cracks	-----	Not allowed Cut and Re-weld	Great stress, sudden cooling, wrong type of electrodes	Visual Inspection

Incorrect Sectional Dimensions A) Depth Weld	-----	B1= +/- 2 mm B2= +/- 2 mm B= +/- 1 mm C= +/- 1 mm Chisel and Grind	Negligence	Template Checking
Insufficient	For weld lengths 11+5 mm, for 12+ 10 mm for shorter seams cut and re-weld or complete to length	-----	Negligence	Rule checking
Back Cuts	If 0.5 mm for 10 mm and C 1 mm For 10 mm replace relevant members	-----	Burnt Material, excessive melting	Visual Inspection
Surface Porosities	Max. 5% of seam area cut and re-weld	-----	Frequent interruptions or welding electrodes inadequately covered	Visual Inspection

Inadequate appearance of weld may be allowed if no other defects that might diminish weld strength are present. Sectional weld shape must comply with design indications. No concave welds shall be allowed for specified convex welds, or vice versa. Tolerance for concavity or convexity of welds shall be $1 \times A$ ("A" being the height of the triangle within the section shown), but more than 0.6 mm.

8. STONE MASONRY

Scope of work :

The work covered under this specifications consists of supplying and erecting stone masonry walls with available best quality of stone in strict compliance with this specifications and applicable drawings.

COURSED STONE MASONRY (First Sort) :

The stone shall be of the type specified such as granite, trap etc. and shall be obtained from the quarries, approved by the Engineer-in-Charge. Stone shall be hard, sound, durable and free from weathering decay and defects like cavities, cracks, flaws, sand holes, injurious veins, patches of loose or soft materials and other similar defects that may adversely affect its strength and appearance. As far as possible stones shall be of uniform colour, quality or texture. Generally stone shall not contain cryptst crystalline silica or chart, mica and other deleterious materials like iron-oxide organic impurities etc.

Stones with round surface shall not be used.

The compressive strength of common types of stones shall be as per IS 1121 (part-1) and the percentage of water absorption shall generally not exceed 5% .

Size of stones

Stones used should be small enough to be lifted and placed by hand. Unless otherwise indicated, the length of stones for stone masonry shall not exceed three times the height and the breadth or base shall not be greater than three-fourth the thickness of wall, or not less than 15 cm. The height of stone may be upto 30 cm.

Dressing

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

Mortar

The mortar for jointing shall be as specified

Laying

All stones shall be wetted before use. The walls shall be carried up truly plumb or to specified batter.

All courses shall be laid truly horizontal and all vertical. its shall be truly vertical. frhe height of each course shall not be less than 15 cm nor more than 30 cm.

Face stones shall be laid alternate headers and stretchers. No pinning shall be allowed on the face No face stone shall be less in breadth than its height and at least one-third of the stones shall tail into the work for length not less than twice their height.

The hearting or the interior filling of the wall shall consist of stones carefully laid on their proper beds in mortar; chips and spalls of stone being used where necessary to avoid thick

beds of joints of mortar and at the same time ensuring that no hollow spaces are left anywhere in the masonry. The chips shall not be used below the hearting stone to bring these upto the level of face stones. The use of chips shall be restricted to the filling of interstices between the adjacent stones in hearting and these shall not exceed 10% of the quantity of stone masonry.

The masonry in a structure shall be carried up uniformly but where breaks are unavoidable, the joints shall be raked back at angle not steeper than 45°. Tothing shall not be allowed

Bond Stones

Bond or through stones running right through the thickness of walls, shall be provided in walls upto 60 m thick and in case of walls above 60 cm thickness, a set of two or more bond stones overlapping each other by atleast 15 cm shall be provided in a line from face of the wall to the back.

In case of highly absorbent types of stones (porous lime stone and sand stone etc.) single piece bond stones may give rise to dampness. For all thicknesses of such walls, a set of two or more bond stones overlapping each other by at least 15 cm shall be provided. Length of each such bond stone shall not be less than two-third of the thickness of the wall.

Where bond stones of suitable lengths are not available precast cement concrete block of 1: 3: 6 mix (1 cement: 3 coarse sand: 6 graded stone aggregate 20 mm nominal size) of cross section not less than 225 square centimetres and length equal to the thickness of wall shall be used in lieu of bond stones. (This shall be applicable only in masonry below ground level and where masonry above ground level is finally required to be plastered).

At least one bond stone or a set of bond stones shall be provided for every 0.5 sqm of the area of wall surface. All bond stones shall be marked suitably with paint as directed by the Engineer-in-Charge.

Bond stones shall be inserted 1.5 to 1.8. metres apart, in every course

Quoins:

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

Joints

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

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

Scaffolding

Single scaffolding having one set of vertical support shall be allowed. The supports shall be sound and strong, tied together by horizontal pieces, over which the scaffolding planks shall be fixed. The inner end of the horizontal scaffolding member may rest in a hole provided in the masonry. Such holes, however, shall not be allowed in pillars under one metre in width or near the skew back of arches. The holes le~ in masonry work for supporting scaffolding shall be filled and made good with cement concrete1: 3 : 6 (1 cement: 3 coarse sand: 6 stone aggregate 20 mm nominal size).

Curing

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

Protection

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

COURSED STONE MASONRY (Second Sort) :

Stone:

shall be as specified in COURSED STONE MASONRY (First Sort)

Size of stones:

shall be as specified in COURSED STONE MASONRY (First Sort)

Dressing:

shall be as specified in COURSED STONE MASONRY (First Sort) except that no portion of dressed surface shall exceed 10 mm from a straight edge placed on it.

Mortar

The mortar for jointing shall be as specified

Laying

Shall be as specified in COURSED STONE MASONRY (First Sort) except that the use of chips shall not exceed 15% of the quantity of stone masonry and stone, in each course need not be of the same height but not more than two stones shall be used in the height of a course

Bond Stones, Quoins:

shall be as specified in COURSED STONE MASONRY (First Sort)

Joints

shall be as specified in COURSED STONE MASONRY (First Sort) but face joints shall not be more than 2 cm thick

Curing, Scaffolding

shall be as specified in COURSED STONE MASONRY (First Sort)

DRESSING OF STONES :

Rough Dressing :

The stone surface to be chisel dressed to one plane by removing all bushings so that the maximum depression is not more than 6 mm.

One Line Dressing :

This is done after the rough dressing is completed by point chiseling so that the variations are not more than 4 mm. Work includes rough dressing also.

Two Line Dressing :

This is done after one line dressing is done by chiseling so that variations are not more than 2.5 mm. Work includes rough and one line dressing also.

Three Line Dressing :

This is done after two line dressing is over by chiseling so that the variations are not more than 1.5 mm. Work includes rough, one line & two line dressing also.

Pal mane Dressing :

After the three line dressing is over the surface is smoothened by using a special pal mane tool to further even out the 3 line dressed surface so that the maximum variation in surface evenness is not more than 1.0 mm. Work includes rough, one line, two line & three line dressing also unless otherwise stated.

RANDOM RUBBLE MASONRY

Stone:

shall be as specified in COURSED STONE MASONRY (First Sort)

Size of stones:

shall be as specified in COURSED STONE MASONRY (First Sort)

Description:

Random rubble masonry shall be uncoursed and the stones shall be of approved size, stones having sharp corners or round surfaces shall not be preferred, The courses are roughly leveled at intervals varying from 30cm to 90cm in height according to the size of stones used

Dressing:

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

Mortar

The mortar for jointing shall be as specified

Laying

All Stones shall be wetted before use. Each stone shall be placed close to the stones already laid so that the thickness of the mortar joints at the face is not more than 20 mm. Face

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

The masonry work in wall shall be carried up true to plumb or to specified batter. Random rubble masonry shall be brought to the level courses at plinth, window sills, lintel and roof levels. Levelling shall be done with concrete comprising of one part of the mortar as used for masonry and two parts of graded stone aggregate of 20 mm nominal size. The masonry in structure shall be carried uniformly. Where the masonry of one part is to be delayed, the work shall be raked back at an angle not steeper than 45°.

Bond stones:

shall be as specified in COURSED STONE MASONRY (First Sort) except Bond stones shall be inserted 1.5 to 1.8. metres apart, in every course

Quoin and Jamb Stones:

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

Joints:

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

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

Curing, Scaffolding, Protection

shall be as specified in COURSED STONE MASONRY (First Sort)

Mode of measurement :

The length, height and thickness shall be measured correct to a cm. The thickness of wall shall be measured at joints excluding the bushing. Only specified dimension shall be allowed; anything extra shall be ignored. The quantity shall be calculated in cubic metre nearest to two places of decimal.

The work under the following categories shall be measured separately:

- (i) From foundation to plinth level (level one) :
 - (a) work in or under water and or liquid mud,
 - (b) work in or under foul positions.
- (ii) From plinth level (Level one) to floor two level.
- (iii) From floor two level to floor three level and soon.
- (iv) Stone masonry in parapet shall be measured together with the corresponding item in the wall of the storey next below.

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

(i) Ends of dissimilar materials (that is, joists, beams, lintels, posts, girders, rafters, purlins, trusses, corbels, steps etc.) upto 0.1 sqm in section.

(ii) Openings each upto 0.1 sqm in area. In calculating the area of openings, any separate lintels or sills shall be included along with the size of opening but the end portions of the lintels shall be excluded and the extra width of rebated reveals, if any, shall also be excluded.

(iii) Wall plates and bed plates, and bearing of chhajjas and the like, where the thickness does not exceed 10 cm and the bearing does not extend over the full thickness of the wall.

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

(iv) Drain holes and recesses for cement concrete blocks to embed hold fasts for doors, windows etc.

(v) Building in masonry, iron fixture, pipes upto 300 mm dia, hold fasts of doors and windows etc.

(vi) Forming chases in masonry each upto section of 350 sq cm. . .

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

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

Square or Rectangular Pillars:

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

Circular Pillars (Columns) :

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

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

Curved Masonry:

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

Rate:

The rate shall include the cost of materials and labour required for all the operations described above and shall include the following:

(a) Raking out joints for plastering or pointing done as a separate item, or finishing flush

as the work proceeds.

(b) Preparing tops and sides of existing walls for raising and extending.

(c) Rough cutting and waste for forming gables cores, skew backs or spandrels of arches, splays at eaves and all rough cutting in the body of walling unless otherwise specified.

(d) Bond stones or cement concrete bond blocks.

(e) Leading and making holes for pipes etc.

(f) Bedding and pointing wall plates, lintels, sills etc. in or on walls, bedding roof tiles and corrugated sheets in or on walls.

(g) Building in ends of joists, beams, lintels etc.

9. CEMENT PLASTERING FOR WALLS AND CEILINGS & SAND FACE PLASTERS.

Scope of work:

The work covered under these specification consists of supplying all material and rendering all types of plaster / pointing finishes strictly in accordance with these specifications, applicable drawings etc.

General :

Cement, sand and water required for the work shall conform to specifications laid down herein before under section cement concrete (plain and reinforced), except that sand for finishing coat shall generally conform to IS 1542-1992. the plastering works shall generally conform to IS 1661:1987 (pt.III) Code of practice for cement plaster finish on walls and ceilings). All general precautions as specified in I.S. 1661-1987 (pt.III) clause 8, shall be taken and preparation of the background shall be done as laid down in IS 1661 clause 12 and IS 2402-2963 shall be generally followed for sand faced plaster work. Scaffolding required for facility of working shall be provided by the contractor at his own cost. This may be double or single according to the requirement and shall be approved by the Engineer-in-charge stage scaffolding shall be erected when ceiling plastering is done. The contractor shall be responsible for accidents if any, take place. The contractor shall co-operate with the other agencies also. Whenever electrical contractor / agency has to fix up switch boxes in walls, necessary Thiyyas, Tapanish or Dhadas shall be arranged to be given in advance of actual plastering process at these locations so that the boxes are fixed properly in lien with finished plaster surface. All finishing in and around these boxes as also around the conduit boxes in ceiling shall be done by plastering contractor without any extra cost to the Owner. The decision of the Engineer-in-charge in this regard shall be final and binding on the contractor.

Cement Plaster :

The cement plaster shall be 12 mm, 15 mm or 20 mm thick as specified in the item.

Scaffolding :

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

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

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

Preparation of Surface :

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

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

Mortar :

The mortar of the specified mix using the type of sand described in the item shall be used. It shall be as specified in Reinforced concrete sub head. For external work and under coat work, the fine aggregate shall conform to grading IV. For finishing coat work the fine aggregate conforming to grading zone V shall be used.

Application of Plaster :

Ceiling plaster shall be completed before commencement of wall plaster.

Plastering shall be started from the top and worked down towards the floor. All putlog holes shall be properly filled in advance of the plastering as the scaffolding is being taken down. To ensure even thickness and a true surface, plaster about 15 x 15 cm shall be first applied, horizontally and vertically, at not more than 2 metres intervals over the entire surface to serve as gauges. The surfaces of these gauged areas shall be truly in the plane of the finished plaster surface. The mortar shall then be laid on the wall, between the gauges with trowel. The mortar shall be applied in a uniform surface slightly more than the specified thickness. This shall be brought to a true surface, by working a wooden straight edge reaching across the gauges, with small upward and side ways movements at a time. Finally the surface shall be finished off true with trowel or wooden float according as a smooth or a sandy granular texture is required. Excessive troweling or over working the float shall be avoided.

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

When suspending work at the end of the day, the plaster shall be left, cut clean to line both horizontally and vertically. When recommencing the plastering, the edge of the old work shall be scrapped cleaned and wetted with cement slurry before plaster is applied to the adjacent areas, to enable the two to properly join together. Plastering work shall be closed at the end of the day on the body of wall and not nearer than 15 cm to any corners or arrises. It shall not be closed on the body of the features such as plasters, bands and cornices, nor at the corners of arrises. Horizontal joints in plaster work shall not also occur on parapet tops and copings as these invariably lead to leakages. The plastering and finishing shall be completed within half an hour of adding water to the dry mortar.

No portion of the surface shall be left out initially to be patched up later on. The plastering and finishing shall be completed within half an hour of adding water to the dry mortar.

Thickness :

Where the thickness required as per description of the item is 20 mm the average thickness of the plaster shall not be less than 20 mm whether the wall treated is of brick or stone. In the case of brick work, the minimum thickness over any portion of the surface shall be not less than 15 mm while in case of stone work the minimum thickness over the bushings shall be not less than 12 mm.

Curing:

Curing shall be started as soon as the plaster has hardened sufficiently not to be damaged when watered.

The plaster shall be kept wet for a period of at least 7 days. During this period, it shall be suitably protected from all damages at the contractor's expense by such means as the Engineer-in-Charge may approve. The dates on which the plastering is done shall be legibly marked on the various sections plastered so that curing for the specified period thereafter can be watched.

Finish:

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

Precaution :

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

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

(ii) To prevent surface cracks appearing between junctions of column/beam and walls, 150 mm wide chicken wire mesh should be fixed with U nails 150 mm centre to centre before plastering the junction. The plastering of walls and beam/column in one vertical plane should be carried out in one go. For providing and fixing chicken wire mesh with U nails payment shall be included in the respective plastering item. No separately payment shall be considered for providing chicken wire mesh.

Measurements :

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

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

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

The following shall be measured separately from wall plaster.

- (a) Plaster bands 30 cm wide and under
- (b) Cornice beadings and architraves or architraves moulded wholly in plaster.
- (c) Circular work not exceeding 6 m in radius.

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

A coefficient of 1.63 shall be adopted for the measurement of one side plastering on honey comb

work having 6 x 10 cm. opening.

Moulded cornices and coves. :

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

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

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

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

Exterior plastering at a height greater than 10m from average ground level shall be measured separately in each storey height. Patch plastering (in repairs) shall be measured as plastering new work, where the patch exceed 2.5 sqm. extra payment being made for preparing old wall, such as dismantling old plaster, raking out the joints and cleaning "the surface.

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

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

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

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

(ii) When two faces of walls are plastered with different types of plaster or if one face is plastered and other is pointed or one face is plastered and other is un plastered, deduction shall be made from the plaster or pointing on the side of the frame for the doors, windows etc. on which width of reveals is less than that on the other side but no deduction shall be made on the other side.

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

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

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

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

Rate :

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

CEMENT PLASTER WITH A FLOATING COAT OF NEAT CEMENT

The cement plaster shall be 12, 15 or 20 mm thick, finished with a floating coat of neat cement, as described in the item.

Specifications for this item of work shall be same as described in Cement plaster except for the additional floating coat which shall be carried out as below.

When the plaster has been brought to a true surface with the wooden straight edge it shall be uniformly treated over its entire area with a paste of neat cement and rubbed smooth, so that the whole surface is covered with neat cement coating. The quantity of cement applied for floating coat shall be 1 kg per sqm. Smooth finishing shall be completed with trowel immediately and in no case later than half an hour of adding water to the plaster mix. The rest of the specifications described in Application of plaster in cement plaster shall apply.

18 MM CEMENT PLASTER (TWO COAT WORK)

The specification for scaffolding and preparation of surface shall be as described in cement plaster subhead

Mortar:

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

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

Application

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

12 mm Under Coat:

This shall be applied as specified in Application of plaster in cement plaster except that when the plaster has been brought to a true surface a wooden straight edge and the surface shall be left rough and furrowed 2 mm deep with a scratching tool diagonally both ways, to form key for the finishing coat. The surface shall be kept wet till the finishing coat is applied.

6mm Finishing Coat:

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

Specifications for Curing, Finishing, Precautions, Measurements and Rate shall be as described under cement plaster subhead

Measurements :

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

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

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

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

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

Flowing soffits (viz. portion under spiral stair case etc.) shall be measured and paid for separately.

Ribs and mouldings on ceiling shall be measured as for cornices, deductions being made from the plastering on ceiling in case the width of the moulding exceed 15 cm.

The mode of measurement of exterior plastering and patch plastering (in repairs) shall be as laid down in cement plaster

Deduction shall not be made for openings or for ends of columns, or columns caps of 0.5 sqm each in area and under. No additions will be made either for the plastering of the sides of such openings. For openings etc. of areas exceeding 0.5 sqm deduction will be made for the full opening but the sides of such openings shall be measured for payment.

Rate:

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

10. CEMENT POINTING

Scaffolding

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

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

Note: In case of special type of work, scaffolding shall be got approved from Engineer-in-Charge in advance.

Preparation of surface

The joints shall be raked out properly. Dust and loose mortar shall be brushed out. Efflorescence if any shall be removed by brushing and scraping. The surface shall then be thoroughly washed with water, cleaned and kept wet before pointing is commenced.

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

The joints shall be raked to such a depth that the minimum depth of the new mortar measured from either the sunk surface of the finished pointing or from the edge of the brick shall not be less than 12 mm.

Mortar

Mortar of specified mix shall be used. It shall be as specified under Reinforced concrete works subhead.

Application and Finishing

The mortar shall be pressed into the raked out joints, with a pointing trowel, either flush, sunk or raised, according to the type of pointing required. The mortar shall not spread over the corner, edges or surface of the masonry. The pointing shall then be finished with the proper tool, in the manner described below:

Flush Pointing : The mortar shall be pressed into the joints and shall be finished off flush and level with the edges of the bricks, tiles or stones so as to give a smooth appearance. The edges shall be neatly trimmed with a trowel and straight edge.

The superfluous mortar shall then be cut off from the edges of the lines and the surface of the masonry shall also be cleaned off all mortar. The finish shall be such that the pointing is to the exact size and shape required and the edges are straight, neat and clean.

Curing

The pointing shall be kept wet for seven days. During this period it shall be suitably protected

from all damages.

The pointing lines shall be truly horizontal and vertical except where the joints are slanting as in rubble random masonry. Lines of joints from different directions should meet neatly at the junctions instead of crossing beyond.

Measurements

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

The various types of pointing for example, struck, keyed, flush, tuck, etc. shall each be measured separately.

Pointing on different types of walls, floors, roofs etc. shall each be measured separately. The type and material of the surface to be pointed shall be described.

Pointing in a single detached joint as for flashing shall be given in running metres.

For jambs, soffits, sills etc. for opening not exceeding 0.5 sqm each in area, ends of joists, beams, posts, girders, steps etc. not exceeding 0.5 sqm each in area and opening not exceeding 3 sqm each deductions and additions shall be made in the following way, in case of pointing on external face only.

(a) No deduction shall be made for ends of joists, beams, posts etc. and openings not exceeding 0.5 sqm each, and no addition shall be made for reveals, jambs, soffits, sills, etc. of these openings.

(b) Deductions for openings exceeding 0.5 sqm but not exceeding 3 sqm each shall be made as follows and no additions shall be made for reveals, jambs, soffits, sills, etc. for these openings.

(c) When both the faces of the wall are pointed with the same pointing deduction shall be made for one face only.

(d) When two faces of wall are pointed with different pointings or if one face is plastered and other is pointed or plastered, deduction shall be made from the plaster or pointing on the side of frames for doors, windows, etc. on which the width of the reveal is less than that on the other side, but no deduction shall be made from the other side.

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

(f) For opening having door frame equal to or projecting beyond thickness of wall, full deduction for jambs, soffits and sills shall be measured.

In case of openings of area above 3sqm each, deduction shall be made for the openings, but jambs, soffits and sills shall be measured

The following shall be measured separately :

(a) Raking out joints for old work only shall be measured and given in Sqm.

(b) Raking out joints of old work built in mud mortar, lime mortar and cement mortar shall each be measured separately.

(c) Raking out joints of different types of old walls, floors etc. shall each be measured separately.

(d) Raking single detached joints as for flashing old work shall be given in running metres.

Rate

The rate shall include the cost of all materials and labour involved in all the operations cement plaster.

11. PAINTING

Scope of work :

The work covered under these specifications consist of furnishing the various types of paints and also the workmanship for these items, in strict compliance with these specifications, which are given in detail here in after with the item of schedule of quantities.

CEMENT PAINT

Material

The cement Paint shall be (conforming to IS 5410) of approved brand and manufacture.

The cement Paint shall be brought to the site of work by the contractor in its original containers is sealed condition. The material shall be brought in at a time in adequate quantities to suffice for the whole work or at least a fortnight's work. The materials shall be kept in the joint custody of the Contractor and the Engineer-in-Charge. The empty containers shall not be removed from the site of work till the relevant item of the work has been completed and permission obtained from the Engineer-in-Charge.

Preparation of Surface

For New Work, the surface shall be thoroughly cleaned of all mortar dropping, dirt dust, algae, grease and other foreign matter by brushing and washing. Pitting in plaster shall be made good and a coat of water proof cement Paint shall be applied over patches after wetting them thoroughly.

Preparation of Mix

Cement Paint shall be mixed in such quantities as can be used up within an hour of its mixing as otherwise the mixture will set and thicken, affecting flow and finish. Cement Paint shall be mixed with water in two stages. The first stage shall comprise of 2 parts of cement Paint and one part of water stirred thoroughly and allowed to stand for 5 minutes. Care shall be taken to add the cement Paint gradually to the water and not vice versa. The second stage shall comprise of adding further one part of water to the mix and stirring thoroughly to obtain a liquid of workable and uniform consistency. In all cases the manufacturer's instructions shall be followed meticulously.

The lids of cement Paint drums shall be kept tightly closed when not in use, as by exposure to atmosphere the cement Paint rapidly becomes air set due to its hygroscopic qualities.

In case of cement Paint brought in gunny bags, once the bag is opened, the contents should be consumed in full on the day of its opening. If the same is not likely to be consumed in full, the balance quantity should be transferred and preserved in an airtight container to avoid its exposure to atmosphere.

Application

The solution shall be applied on the clean and wetted surface with brushes or spraying machine. The solution shall be kept well stirred during the period of application. It shall be applied on the surface which is on the shady side of the building so that the direct heat of the sun on the surface is avoided. The method of application of cement Paint shall be as per manufacturer's specification. The completed surface shall be watered after the day's work.

The second coat shall be applied after the first coat has been set for at least 24 hours. Before application of the second or subsequent coats, the surface of the previous coat shall not be wetted.

For new work, the surface shall be treated with three or more coats of water proof cement Paint as found necessary to get a uniform shade.

For old work, the treatment shall be with one or more coats as found necessary to get a uniform shade.

Precaution

Water proof cement Paint shall not be applied on surfaces already treated with white wash, colour wash, distemper dry or oil bound, varnishes, Paints etc. It shall not be applied on gypsums, wood and metal surfaces.

If water proofing cement is required to be applied on existing surface, previously treated with white wash, colour wash etc., the surface shall be thoroughly cleaned by scrapping off all the white wash, colour wash etc. completely. Thereafter, a coat of cement primer shall be applied followed by two or more coat. of water proof cement.

The specifications in respect of scaffolding, protective measures, measurements and rate shall be as described under white washing with lime.

EXTERIOR PAINTING ON WALL

Material

The paint shall be (Textured exterior paint/Acrylic smooth exterior paint/premium acrylic smooth exterior paint) of approved brand and manufacture.

This paint shall be brought to the site of work by the contractor in its original containers in sealed condition. The material shall be brought in at a time in adequate quantities to suffice for the whole work or at least a fortnight's work. The materials shall be kept in the joint custody of the contractor and the Engineer-in-Charge. The empty containers shall not be removed from the site of work till the relevant item of work has been completed and permission obtained from the Engineer-in-Charge.

Preparation of Surface

For new work, the surface shall be thoroughly cleaned off all mortar dropping, dirt dust, algae, fungus or moth, grease and other foreign matter of brushing and washing, pitting in plaster shall make good, surface imperfections such as cracks, holes etc. should be repaired using white cement. The prepared surface shall have received the approval of the Engineer in charge after inspection before painting is commenced.

Application

Base coat of water proofing cement paint

All specifications in respect of base coat of water proofing cement paint shall be as described under Cement Paint subhead above.

Before pouring into smaller containers for use, the paint shall be stirred thoroughly in its container, when applying also the paint shall be continuously stirred in the smaller containers so that its consistency is kept uniform. Dilution ratio of paint with potable water can be altered

taking into consideration the nature of surface climate and as per recommended dilution given by manufacturer. In all cases, the manufacturer's instructions & directions of the Engineer-in-charge shall be followed meticulously.

The lids of paint drums shall be kept tightly closed when not in use as by exposure to atmosphere the paint may thicken and also be kept safe from dust.

Paint shall be applied with a brush on the cleaned and smooth surface. Horizontal strokes shall be given, First and vertical strokes shall be applied immediately afterwards. This entire operation will constitute one coat. The surface shall be finished as uniformly as possible leaving, no brush marks.

The specifications in respect of scaffolding, protective measures, measurements and rate shall be as described under White washing with lime subhead above.

PAINTING

Materials

Paints, oils, varnishes etc. of approved brand and manufacture shall be used. Only ready mixed Paint (Exterior grade) as received from the manufacturer without any admixture shall be used.

If for any reason, thinning is necessary in case of ready mixed Paint, the -brand of thinner recommended by the manufacturer or as instructed by the Engineer-in-Charge shall be used.

Approved Paints, oil or varnishes shall be brought to the site of work by the contractor in their original containers in sealed condition. The material shall be brought in at a time in adequate quantities to suffice for the whole work or at least a fortnight's work. The materials shall be kept in the joint custody of the contractor and the Engineer-in-Charge. The empties shall not be removed from the site of work, till the relevant item of work has been completed and permission obtained from the Engineer-in-Charge.

Commencing Work

Painting shall not be started until the Engineer-in-Charge has inspected the items of work to be painted, satisfied himself about their proper quality and given his approval to commence the painting work. Painting of external surface should not be done in adverse weather condition like hail storm and dust storm.

Painting, except the priming coat, shall generally be taken in hand after practically finishing all other building work.

The rooms should be thoroughly swept out and the entire building cleaned up, at least one day in advance of the Paint work being started.

Preparation of Surface

The surface shall be thoroughly cleaned and dusted off. All rust, dirt, scales, smoke splashes, mortar droppings and grease shall be thoroughly removed before painting is started. The prepared surface shall have received the approval of the Engineer-in-Charge after inspection, before painting is commenced.

Application

Before pouring into smaller containers for use, the Paint shall be stirred thoroughly in its containers, when applying also, the Paint shall be continuously stirred in the smaller containers

so that its consistency is kept uniform.

The painting shall be laid on evenly and smoothly by means of crossing and laying off, the latter in the direction of the grains of wood. The crossing and laying off consists of covering the area over with Paint, brushing the surface hard for the first time over and then brushing alternately in opposite direction, two or three times and then finally brushing lightly in a direction at right angles to the same, In this process, no brush marks shall be left after the laying off is finished. The full process of crossing and laying off will constitute one coat.

Where so stipulated, the painting shall be done by spraying, Spray machine used may be (a) high pressure (small air aperture) type, or (b) a low pressure (large air gap) type, depending on the nature and location of work to be carried out. Skilled and experienced workmen shall be employed for this class of work. Paints used shall be brought to the requisite consistency by adding a suitable thinner.

Spraying should be done only when dry condition prevails. Each coat shall be allowed to dry out thoroughly and rubbed smooth before the next coat is applied, This should be facilitated by thorough ventilation. Each coat except the last coat, shall be lightly rubbed down with sand paper or fine pumice stone and cleaned off dust before the next coat is laid.

No left over Paint shall be put back into the stock tins. When not in use, the containers shall be kept properly closed.

No hair marks from the brush or clogging of Paint puddles in the corners of panels, angles of mouldings etc. shall be left on the work.

In painting doors and windows, the putty round the glass panes must also be painted but care must be taken to see that no Paint stains etc. are left on the glass. Tops of shutters and surfaces in similar hidden locations shall not be left out in painting. However, bottom edge of the shutters where the painting is not practically possible, need Dot be done nor any deduction on this account will be done but two coats of primer of approved make shall be done on the bottom edge before fixing the shutters.

On painting steel work, special care shall be taken while painting over bolts, nuts, rivets overlaps etc.

The additional specifications for primer and other coats of Paints shall be as according to the detailed specifications under the respective headings.

Brushes and Containers

After work, the brushes shall be completely cleaned of Paint and linseed oil by rinsing with turpentine. A brush in which Paint has dried up is ruined and shall on no account be used for painting work. The containers when not in use, shall be kept closed and free from air so that Paint does not thicken and also shall be kept from dust. When the Paint has been used, the containers shall be washed with turpentine and wiped dry with soft clean cloth, so that they are clean, and can be used again.

Measurements

The length and' breadth shall be measured correct to a cm. The area shall be calculated in sqm (Correct to two places of decimal), except otherwise stated.

Small articles not exceeding 10 sq. decimetre (0.1 sqm) of painted surfaces where not in conjunction with similar painted work shall be enumerated.

Painting upto 10 cm in width or in girth and not in conjunction with similar painted work shall be given in running metres and shall include cutting to line where so required.

Note: Components of trusses, compound girders, stanchions, lattices and similar work shall, however, be given in sq. metres irrespective of the size or girth of members. Priming coat of painting shall be included in the work of fabrication.

In measuring painting, varnishing, oiling etc. of joinery and steel work etc. The coefficients as indicated in following tables shall be used to obtain the area payable. The coefficients shall be applied to the areas measured flat and not girthed.

Measurements of wall surfaces shall be recorded as per actual.

Precautions

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

Rate

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

PAINTING PRIMING COAT ON PLASTERED SURFACES

Plastered Surface:

The surface shall ordinarily not be painted until it has dried completely. Trial patches of primer shall be laid at intervals and where drying is satisfactory, painting shall then be taken in hand. Before primer is applied, holes and undulations, shall be filled up with plaster of paris and rubbed smooth.

Application

The primer shall be applied with brushes, worked well into the surface and spread even and smooth. The painting shall be done by crossing and laying off as described in exterior painting on wall.

12. FENCING WORK WITH BARBED WIRE, CHAIN LINK ETC.,

The work shall generally be carried out as per these specifications, relevant drawings and as directed by the Engineer-in-charge.

M.S. Posts and Struts :

All the M.S. posts / struts shall be free from rust, scale, cracks, twists and other defects and shall be fabricated to the required shape and size out of the specified sections. The posts and struts shall be conforming to relevant specifications stipulated herein before under relevant sections. All the posts and struts shall be of sizes and lengths as specified in the tender schedule. The exposed surfaces of the posts and struts shall be painted with two coats of approved primer.

Spacing of the Posts and Struts :

The spacing of posts shall be 3 m. center to center unless other wise specified or as directed by the Engineer to suit the dimensions of the area to be fenced. Every 10th posts, last but one end posts, corner posts, and posts where the level of fencing changes in steps and end post when the fencing changes its direction shall be strutted on both sides or as directed by the Engineer. End posts where barbed wire fencing is discontinued shall be strutted on one side only.

Fixing of M.S. / R.C.C. Posts and Struts :

Pits of size 45 X 45 X 45 cm. deep or sizes mentioned in the drawings, shall first be excavated centrally in the direction of proposed fencing work, true to line and level to receive the posts. In case of struts, the pits shall be so excavated, as to receive minimum 15cm. concrete cover at any point of the struts to suit its inclination or as shown in the drawing.

The pits shall be filled with a layer of 15cm. thick cement concrete of specified mix. The posts and struts shall then be placed in the pits, the posts projecting to the specified height above ground level, true to line, plumb and position, by providing adequate supports temporarily, and cement concrete of specified mix, shall then be filled in so that the posts are embedded in cement concrete blocks of specified sizes. The concrete in foundation shall be watered for atleast 7 days to ensure proper curing.

Barbed Wire :

The barbed wire shall be of M.S. or G.I. as specified and it shall generally conform to I.S. 278-1978. The base metal of the line and point wire shall be of good commercial quality mild steel. The line and point wire shall be circular in section, free from scales and other defects and shall be uniformly galvanized if specified.

The line wire shall be in continuous lengths and shall generally be free from signs of welds. It shall be able to withstand wrapping and unwrapping 8 turns round its diameter. The barbed wire shall consist of two splices per reel. The barbed wire shall be formed by twisting two lines wires one containing the barbs.

The barbed wire and its weight shall be as given in the table below:

Type	Nominal diameter of wire		Nominal distance between two barbs in mm.	Mass of complete barbed wire (in gm./m)
	Line wire (in mm)			Point wire (in mm)
1	2.50 (12G)	2.50 (12G)	75	146 (136-155)
2	2.50	2.50	150	114(108-120)
3	2.50	2.00 (14 G)	75	117(108-125)
4	2.50	2.00	150	96(89-103)
5	2.24 (13G)	2.00	75	102(97-106)
6	2.24	2.00	150	82(78-85)

The barbs shall carry four points and shall be formed by twisting two point wires, each two turns, tightly round one line wire, making altogether 4 (four) complete turns. The barbs shall be so finished that the four points are set and locked at right angles to each other.

The barbs shall have a length of not less than 13mm and not more than 18mm. The points shall be sharp and well pointed. Barbed spacing shall be as given in the above table. Wherever required for every 50 reels or part thereof, samples of the barbed wire and the individual line wires shall be put to tensile test and in case of failure to conform to tensile properties given below, two additional tests of each kind shall be made on the samples cut from other reels.

Tensile Properties :

Size of line wire Nominal dia (in mm)	Breaking load of line wire		Min breaking load of complete barbed wire (in kg.)
	Min (in kg)	Max (in kg)	
2.50 (12G)	216	302	444
2.24 (13G)	128	179	263

On the results of these additional tests, the whole or portion of the barbed wire shall be accepted or discarded as the case may be.

Fixing of Barbed Wire :

The barbed wire shall be stretched and fixed in number of rows and two diagonals as specified. The bottom row shall be 140mm above ground and the rest at 125 mm or at given spacing as per drawing. The diagonals shall be stretched between adjacent posts from top wire of one post to the bottom wire of the 2nd post. The diagonal wires will be interwoven with horizontal wires by fixing the odd rows of wires, then the diagonal cross wires and lastly the even rows of wires. The jointing of the barbed wire in between the posts shall not be permitted.

Necessary holes should be tapped in the posts and the barbed wire shall be fixed in position by means of "U" clamps or bolts and nuts as specified in drawings. In case of fixing with "U" clamps, the legs of the "U" clamps passing through the 10mm dia hole in the RCC post to hold barbed wire shall be turned up and down to get an overlap of 25mm on the face of RCC post. Turn buckles and straining bolts shall be used at the end posts if specified.

Mode of Measurement :

The work shall be measured in Numbers length of fencing correct to a centimeter for the

finished work, from center to center of the posts. The rate shall include the cost of labor ,material and Transportation to the required location involved in all the operations described above including the cost of turn buckle, straining bolts, bolts and the nuts / U clamps including excavation and foundation concrete or as specified in item description for the work.

LIST OF APPROVED MAKE OF MATERIALS FOR CIVIL WORKS

S.NO	ITEM DESCRIPTION	MANUFACTURER / COMPANY
1	CEMENT	: ACC, BIRLA SUPER, CCI, ULTRATECH, SANGHI
2	WHITE CEMENT	: JK, BIRLA
3	REINFORCEMENT STEEL	: SAIL, TISCO, RINL VIZAG, KAMDHENU
4	STRUCTURAL ROLLED STEEL SECTIONS	: SAIL, TISCO, RINL VIZAG, JINDAL
5	STRUCTURAL HOLLOW STEEL SECTIONS AND TUBULAR SECTIONS	: SAIL, TISCO, RINL VIZAG, JINDAL
6	SHUTTERING PLY WOOD	: KITPLY, ANCHOR, GREEN, CENTURY
7	GROUT's, ADMIXTURE's, SEALANT's	: FOSROC / BASF / SIKA
8	JOINT FILLERS, SILICON PAINTS	: DOW CORNING / SIKA
9	PAINTS EXTERIOR	: ASIAN PAINT / ICI PAINTS / BERGER (WEATHER SHEILD AND WEATHER SHEILD MAX)