Annexure IV

K / W - 4

OFFICE OF THE EXECUTIVE ENGINEER (SOUTH),
HUBBALLI-DHARWAD MUNICIPAL CORPORATION- 580028
Telephone No: 0836-2213890
E-Mail: .....

TENDERS FOR THE WORK OF

Construction of Electrical Crematorium at Harishchandra Burial Ground in ward No.50

TENDER REFERENCE	:	DMA/2017-18/OW/WORK_INDENT66077
PERIOD OF SALE OF TENDER DOCUMENT	:	
LAST DATE FOR SALE OF TENDER DOCUMENT	:	23/01/2018 4.00 Pm
LAST DATE AND TIME FOR RECEIPT OF TENDERS	:	23/01/2018 4.00 Pm
	:	
TIME AND DATE OF OPENING OF COVER ONE OF TENDERS[1]	:	25/01/2018 11.00 Am
PLACE OF OPENING OF COVER ONE OF TENDERS	:	Executive Engineer (South),HDMC. Hubballi
TIME AND DATE OF OPENING OF COVER TWO OF TENDERS	:	Will be intimated to the Qualified Tenderers
PLACE OF OPENING OF COVER TWO OF TENDERS	:	Will be intimated to the Qualified Tenderers
ADDRESS FOR COMMUNICATION	:	Executive Engineer (South),HDMC. Hubballi PH:0836-2213890

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SECTION 1: INVITATION FOR TENDERS (IFT)

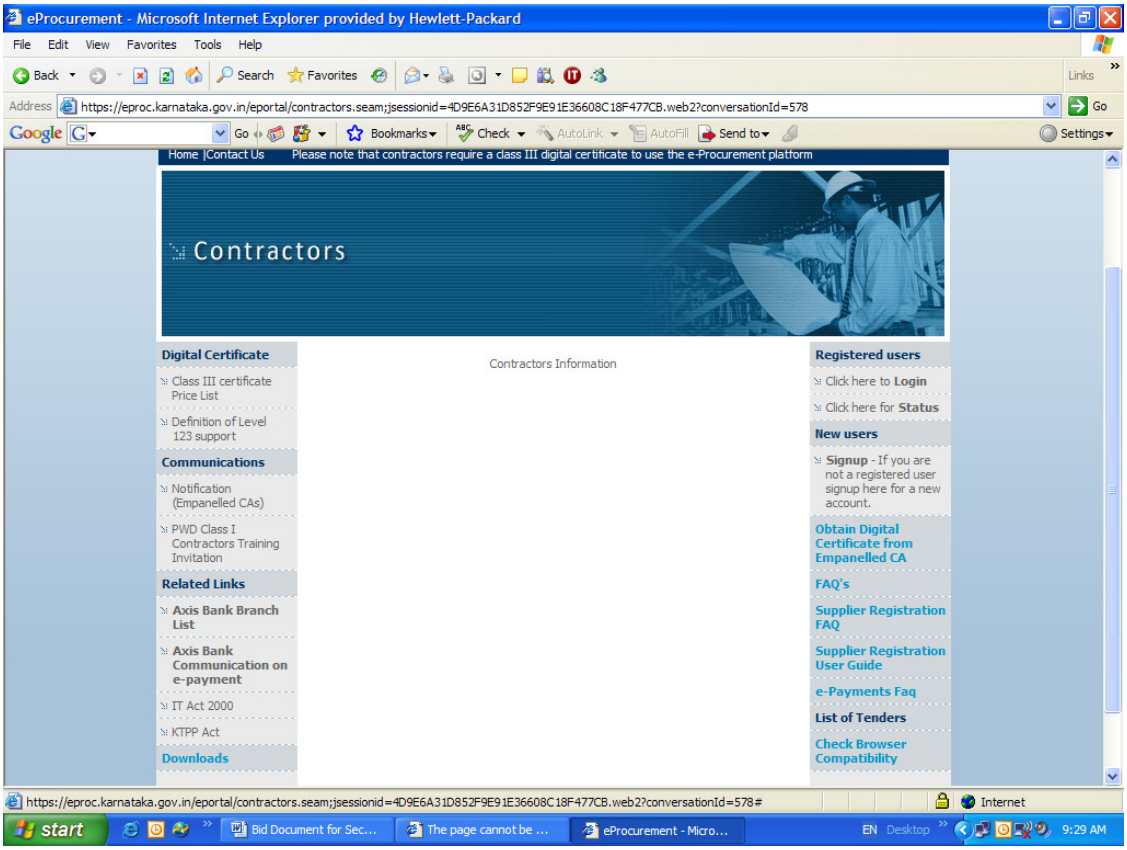
Tender Notification No:

Work Indent No: DMA/2017-18/OW/WORK_INDENT66077

The Executive Engineer (South),HDMC. Hubballi invites tenders from eligible tenderers, for the construction of works detailed in the Table below. **Two Cover Tender procedure as per Rule 28 of the KTPP Act shall be followed. The Tenders are required to submit two separate sealed covers, one containing the Earnest money deposit and the details of their capability to undertake the tender (as detailed in ITT Clause 3 and 6), which will be opened first and the second cover containing the price tender which will be opened only if the tenderer is found to be qualified to execute the tendered work. The tenderers are advised to note the minimum qualification criteria specified in Clause 3 of the Instructions to tenderer to qualify for award of the contract.**

1. **Tender documents may be downloaded from Government of Karnataka E-Procurement website https://eproc.karnataka.gov.in/eportal/index.seam under login for Contractors:**

After login to Contractors, please scroll down to the right-side bottom to see List of Tenders, Please click there to find the details of NIT and download copy of the tender.



The tender can be downloaded in the portal as per prescribed date and time published in the portal. Only Interested Contractors who wish to participate should remit online tender processing fee, after registering in the portal. The tender processing fee /transaction fee is non-refundable.

3. Tenders must be accompanied by earnest money deposit specified for the work in the Table below. **Earnest Money deposit which will be paid online through e-Procurement portal.** Earnest money deposit will have to be in any one of the forms as specified in the E procurement portal and shall have to be valid for **45 days beyond** the validity of the tender.

4. Tenders must be electronically submitted (on-line through internet) within the date and time published in e-procurement portal. First Cover (Technical Bid) of the Tenders will be opened after prescribed time and date in the e-procurement portal, in the presence of the Tenderers who wish to attend at the Office of The Executive Engineer (South),HDMC. Hubballi

5. A Pre-tender meeting will be held on the *time*, *date and* Place *specified in the e-procurement portal* to clarify the issues if any, and to answer questions on any matter that may be raised at that stage as stated in Clause 8.2 of 'Instructions to Tenderer' of the tender document.

6. Other details can be seen in the tender documents.

TABLE

Sl. No	Name of work	Value of work (In Rs. Lakh)	Earnest Money Deposit (In Rs.in lakhs)	Cost of document	Period of completion
1.	Construction of Electrical Crematorium at Harishchandra Burial Ground in ward No.50	170	2.55	As per e-portal	6 (Six) Calendar months (including monsoon)

Executive Engineer
(South)
HUBBALLI-DHARWAD
MUNICIPAL
CORPORATION,
HUBBALLI

SECTION 2: INSTRUCTIONS TO TENDERERS (ITT)

Table of Clauses

A. General

1. Scope of Tender

1.1 **The Executive Engineer (South),HDMC. Hubballi** (Referred to as Employer in these documents) invites tenders following Two Cover tender procedure, from eligible Tenderers, for the construction of works (as defined in these documents and referred to as "the works") detailed in the Table given in the Invitation for Tenders (IFT). The Tenderers may submit tenders for any or all of the works detailed in the table given in IFT.

2. Eligible Tenderers

2.1 Tenderers shall not be under a declaration of ineligibility for corrupt and fraudulent practices issued by the Government of Karnataka

2.2 Tenders from Joint ventures are not acceptable.

3. Qualification of the Tenderer:

3.1 All Tenderers shall provide the requested information accurately and in sufficient detail in Section 3: Qualification information.

3.2 To qualify for award of this contract, each Tenderer in its name should have in the last five years (i.e. 2012-13 TO 2016-17)

a. achieved in at least two financial years a minimum financial turnover (in all classes of civil engineering construction works only) of Rs 340 lakh.
b. satisfactorily completed the work of at least one similar work of Electric Crematorium as prime contractor of value not less than Rs. 85 lakh.
c. executed in any one year, the following minimum quantities of work:

Sl. No	Item Description	Unit	Quantity executed
1	Earthwork excavation	Cum	1300
2	RCC / PCC	Cum	180
3	TMT	MT	13

d. Deleted
e. Deleted

3.3 Each Tenderer should further demonstrate:

a. availability by owning at least 50% of the required key and critical equipment for this work and the remaining 50% can be deployed on lease /hire basis for all works provided, the relevant documents (Applicants shall indicate the make, year of manufacture, capacity and working conditions of each of the equipment along with RC issued by R.T.O. / Sale deed/purchase invoice, hire/lease agreements) shall be furnished.

Sl No	Key / critical Equipment	Min Required
1.	Excavator	01 No.
2.	Concrete Mixer	02 Nos
3.	Plate & Needle Vibrator	02 Nos
4.	Tipper / Lorry	01 No.
5.	Water Tanker	01 No.

b. liquid assets and /or availability of credit facilities of no less than Rs 51.00 Lakhs (Credit lines/ letter of credit/ certificates from banks for meeting the fund requirement etc. (usually the equivalent of the estimated cash flow for three months in the peak construction period)

BANKER'S CERTIFICATE

This is to certify that M/s. ..... is a reputed company with a good financial standing. If the contract for this work "**Construction of Electrical Crematorium at Harishchandra Burial Ground in ward No.50**" is awarded to the above firm, we shall be able to provide overdraft/credit facilities to the extent of **Rs.....** to meet the working capital requirements for executing the above contract

Sd/-
Senior Bank Manger,
Name of the Bank, Address

3.4 To qualify for a package of contracts made up of this and other contracts for which tenders are invited in this IFT, the Tenderer must demonstrate having experience and resources to meet the aggregate of the qualifying criteria for the individual contracts.

3.5 Sub-contractors' experience and resources shall not be taken into account in determining the Tenderer's compliance with the qualifying criteria except to the extent stated in 3.2 (d) (e) and (f) above.

3.6 Tenderers who meet the above specified minimum qualifying criteria, will only be qualified, if their available tender capacity is more than the total tender value. The available tender capacity will be calculated as under:

Assessed available tender capacity = (A*N*1.5 - B)

where

A = Maximum value of civil engineering works executed in any one year during the last five years
(updated to 2016-17 price level) taking into account the completed as well as works in progress.
N = Number of years prescribed for completion of the works for which tenders are invited.
B = Value, at 2016-17 price level, of existing commitments and on-going works to be completed during the next (6 /12) years.

Note: *The statements showing the value of existing commitments and on-going works as well as the stipulated period of completion remaining for each of the works listed should be countersigned by the Employer in charge, not below the rank of an Executive Engineer or equivalent.*

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

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

- record of poor performance such as abandoning the works, not properly completing the contract, inordinate delays in completion, litigation history, or financial failures etc.; and/or

- participated in the previous Tender for the same work and had quoted unreasonably high tender prices and could not furnish rational justification.

4. One Tender per Tenderer:

4.1 Each tenderer shall submit only one tender for one package. A tenderer who submits or participates in more than one Tender will cause all the proposals with the Tenderer's participation to be disqualified.

5. Cost of Tendering:

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

6. Site visit:

6.1 The Tenderer at his own responsibility and risk is encouraged to visit and examine the Site of Works and its surroundings and obtain all information that may be necessary for preparing the Tender and entering into a contract for construction of the Works. The cost of visiting the Site shall be at the Tenderer's own expense.

B. Tender documents

7. Content of Tender documents

7.1 The set of tender documents shall have all the Sections given in Page 2: Contents

7.2 Both the sets should be completed and uploaded on e-portal.

8. Clarification of Tender Documents

8.1 A prospective tenderer requiring any clarification of the tender documents may notify the Employer in writing or by cable (hereinafter "cable" includes telex and facsimile) at the Employer's address indicated in the invitation to tender. The Employer will respond to any request for clarification which he receives earlier than 15 days prior to the deadline for submission of tenders. Copies of the Employer's response will be uploaded on e-portal, including a description of the enquiry but without identifying its source.

8.2 Pre-tender meeting:

8.2.1 The tenderer or his authorized representative is invited to attend a pre-tender meeting which will take place at Office of **The Executive Engineer (South),HDMC. Hubballi** on 03/01/2018 at 12.00 Pm.

8.2.2 The purpose of the meeting will be to clarify issues and to answer questions on any matter that may be raised at that stage

8.2.3 The tenderer is requested to submit any questions in writing or by cable to reach the Employer not later than one week before the meeting.

8.2.4 Minutes of the meeting, including the text of the questions raised (without identifying the source of enquiry) and the responses given will be transmitted without delay on e-portal. Any modification of the tender documents listed in Sub - Clause 7.1 which may become necessary as a result of the pre-tender meeting shall be made by the Employer exclusively through the issue of an Addendum pursuant to Clause 9 and not through the minutes of the pre-tender meeting.

8.2.5 Non-attendance at the pre-tender meeting will not be a cause for disqualification of a tenderer.

9. Amendment of Tender documents

9.1 Before the deadline for submission of tenders, the Employer may modify the tender documents by issuing addenda.

9.2 Any addendum thus issued shall be part of the tender documents and shall be communicated in writing or by cable to all the purchasers of the tender documents.

9.3 To give prospective Tenderers reasonable time in which to take an addendum into account in preparing their tenders, the Employer shall extend as necessary the deadline for submission of tenders, in accordance with Sub-Clause 16.2 below.

C. Preparation of Tenders

10. Documents comprising the Tender

10.1 The tender submitted by the Tenderer shall be in two covers and shall contain the documents as follows:

10.1.1 First Cover:

(a) Earnest Money Deposit;
(b) Qualification Information as per formats given in Section 3;

10.1.2 Second Cover:

(a) The Tender (in the format indicated in Section 4)
(b) Priced Bill of Quantities (Section 9);

and any other materials required to be completed and submitted by Tenderers in accordance with these instructions. The documents listed under Sections 3, 4, 6 and 9 shall be filled in without exception.

10.2 Tenderers submitting tenders together with other contracts stated in the IFT to form a package will so indicate in the tender together with any discounts offered for the award of more than one contract.

11. Tender prices

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

11.2 The Tenderer shall fill in rates and prices and line item total (as per the format in e-portal) for all items of the Works described in the Bill of Quantities along with total tender price.

Items for which no rate or price is entered by the Tenderer will not be paid for by the Employer when executed and shall be deemed covered by the other rates and prices in the Bill of Quantities.

11.3 All duties, taxes, and other levies payable by the contractor under the contract, or for any other cause, shall be included in the rates, prices and total Tender Price submitted by the Tenderer.

11.4 The rates and prices quoted by the Tenderer shall be subject to adjustment during the performance of the Contract in accordance with the provisions of Clause of the Conditions of Contract

12. Tender validity

12.1 Tenders shall remain valid for a period not less than ninety days after the deadline date for tender submission specified in Clause 16. A tender valid for a shorter period shall be rejected by the Employer as non-responsive.

12.2 In exceptional circumstances, prior to expiry of the original time limit, the Employer may request that the Tenderers may extend the period of validity for a specified additional period. The request and the Tenderers' responses shall be made in writing or by cable. A Tenderer may refuse the request without forfeiting his earnest money deposit. A Tenderer agreeing to the request will not be required or permitted to modify his tender, but will be required to extend the validity of his earnest money deposit for a period of the extension, and in compliance with Clause 13 in all respects.

13. Earnest money deposit

13.1 **Earnest Money Deposit/ Bid security**

The supplier/contractor can pay the Earnest Money Deposit (EMD) in the e-Procurement portal using any of the following payment modes: (For detailed procedures visit e-procurement portal)

1 Credit Card
2 Direct Debit/ Net Banking
3 National Electronic Fund Transfer (NEFT)
4 Over the Counter (OTC) payment

The contractor shall furnish the requisite EMD only through e-payment, in favour of **The Executive Engineer (South),HDMC. Hubballi**

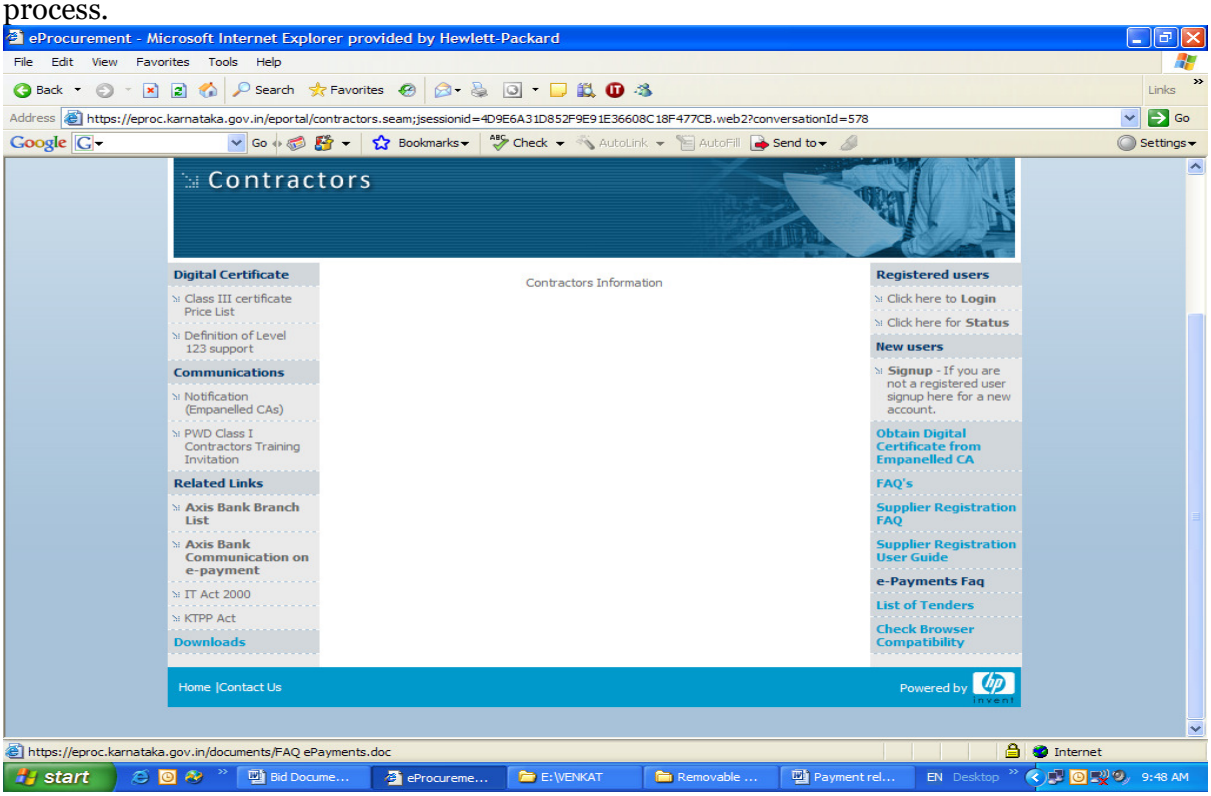
The supplier/contractor's bid will be evaluated only on confirmation of receipt of the payment (EMD) in the Government of Karnataka central pooling a/c held at designated Bank

EMD amount will have to be submitted by the supplier/contractor taking into account the following conditions:

a. EMD will be accepted only in the form of electronic cash (and not through Demand Draft or Bank Guarantee) and will be maintained in the Govt.'s central pooling account at Designated Bank until the contract is closed.

b. The entire EMD amount for a particular tender has to be paid in a single transaction

For details on e-Payment services refer to e-procurement portal for more details on the process.



Refund of EMD

Based on the instructions of Tender Accepting Authority (TAA) the EMD amount of the unsuccessful bidders will be refunded to the respective Bank a/c's of the supplier/contractor registered in the e-Procurement system.

13.2 Instruments having fixed validity issued as earnest money deposit for the tender shall be valid for 45 days beyond the validity of the tender

13.3 Any tender not accompanied by an acceptable earnest money deposit and not secured as indicated in Sub-Clauses 13.1 and 13.2 above shall be rejected by the Employer as non-responsive.

13.4 The earnest money deposit of unsuccessful Tenderers will be returned within 30 days of the end of the tender validity period specified in Sub-Clause 12.1.

13.5 The earnest money deposit of the successful Tenderer will be discharged when the Tenderer has signed the Agreement and furnished the required Performance Security.

13.6 The earnest money deposit may be forfeited:

(a) if the Tenderer withdraws the Tender after tender opening during the period of tender validity;

(b) if the Tenderer does not accept the correction of the Tender Price, pursuant to Clause 24; or

(c) in the case of a successful Tenderer, if the Tenderer fails within the specified time limit to

(i) sign the Agreement; or

(ii) furnish the required Security deposit

14. Format and signing of Tender

Tenderer shall submit the Bid electronically before the submission date and time notified in e-procurement portal.

D. Submission of Tenders

15. Submission of Tender

Tenderer shall submit the Bid electronically before the submission date and time notified in e-procurement portal.

16. Deadline for submission of the Tenders

16.1 In online e-procurement system, tenderer shall not be able to submit the bid after the bid submission time and date as the icon or the task in the e-procurement portal will not be available.

16.2 The Employer may extend the deadline for submission of tenders by issuing an amendment in accordance with Clause 5, in which case all rights and obligations of the Employer and the Tenderers previously subject to the original deadline will then be subject to the new deadline.

17. Late Tenders

17.1 In online e-procurement system, you shall not be able to submit the bid after the bid submission time and date as the icon or the task in the e-procurement portal will not be available.

18. Modification and Withdrawal of Tenders

Tender has all the time to modify and correct or upload any relevant document in the portal till Bid submission date and time, as published in the e-procurement portal.

E- Tender opening and evaluation

19. Opening of First Cover of all Tenders and evaluation to determine qualified Tenderers:

19.1 The Employer will open online the First Covers of all the Tenders received through e-procurement portal, in the presence of the Tenderers or their representatives who choose to attend at the date, time and the venue specified in the e-procurement portal. In the event of the specified date of Tender opening being declared a holiday for the Employer, the Tenders will be opened at the appointed time and location on the next working day.

19.2 Not Applicable

19.3 The Tenderers names, the presence or absence of earnest money deposit (amount, format and validity), the submission of qualification information and such other information as the Employer may consider appropriate will be announced by the Employer at the opening.

The Employer shall prepare minutes of the Tender opening, including the information disclosed to those present in accordance with Sub-Clause 19.3

19.4 – NA -

19.5 The Employer will evaluate and determine whether each tender (a) meets the eligibility criteria defined in ITT Clause 2; (b) is accompanied by the required earnest money deposit as per stipulations in ITT Clause and (c) meets the minimum qualification

criteria stipulated in ITT Clause 3. The Employer will draw out a list of qualified Tenderers.

20. Opening of Second Cover of qualified Tenderers and evaluation:

20.1 The Employer will inform all the Qualified Tenderers the time, date and venue fixed for the opening of the Second Cover containing the priced Tenders. The Employer will open online the Second Covers of Qualified Tenderers at the date, time and the venue specified in the e-procurement portal, in the presence of the Tenders or their representatives who choose to attend. In the event of the specified date of Second Cover opening being declared a holiday for the Employer, the Second Covers will be opened at the appointed time and location on the next working day.

20.2 Not Applicable

20.3 The Tenderers' names, the Tender prices, the total amount of each Tender, and such other details as the Employer may consider appropriate, will be announced by the Employer at the opening.

20.4 The employer shall prepare minutes of the tender opening including the information disclosed to those present in accordance with the sub clause 20.3

21. Process to be confidential

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

22. Clarification of Tenders

22.1 To assist in the examination, evaluation, and comparison of Tenders, the Employer may, at his discretion, ask any Tenderer for clarification of his Tender, including breakdowns of unit rates. The request for clarification and the response shall be in writing or by cable, but no change in the price or substance of the Tender shall be sought, offered, or permitted.

22.2 Subject to sub-clause 22.1, no Tenderer shall contact the Employer on any matter relating to its Tender from the time of the Tender opening to the time the contract is awarded. If the Tenderer wishes to bring additional information to the notice of the Employer, it should do so in writing.

22.3 Any effort by the Tenderer to influence the Employer in the Employer's Tender evaluation, Tender comparison or contract award decisions may result in the rejection of the Tenderers' Tender.

23. Examination of Tenders and determination of responsiveness

23.1 Prior to the detailed evaluation of Tenders, the Employer will determine whether each Tender; (a) has digitally signed; and; (b) is substantially responsive to the requirements of the Tender documents.

23.2 A substantially responsive Tender is one which conforms to all the terms, conditions, and specifications of the Tender 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 Tender documents, the Employer's rights or the Tenderer's obligations under the Contract; or (c) whose rectification would affect unfairly the competitive position of other Tenderers presenting substantially responsive Tenders.

23.3 If a Tender is not substantially responsive, it will be rejected by the Employer, and may not subsequently be made responsive by correction or withdrawal of the nonconforming deviation or reservation.

24. Correction of errors

The Tenderer can do Modification/corrections/changes to their bids till the last time and date of submission of bid in e-Procurement Portal only

25. Evaluation and comparison of Tenders

25.1 The Employer will evaluate and compare only the Tenders determined to be substantially responsive in accordance with Clause 23.

25.2 The Employer reserves the right to accept or reject any variation, deviation, or alternative offer. Variations, deviations, and alternative offers and other factors which are in excess of the requirements of the Tender documents or otherwise result in unsolicited benefits for the Employer shall not be taken into account in Tender evaluation.

25.4 The estimated effect of the price adjustment conditions under Clause 41 of the Conditions of Contract, during the implementation of the Contract, will not be taken into account in tender Evaluation

25.5 If the tender of the successful tenderer is seriously unbalanced in relation to the Employer's estimate of the cost of the work to be performed under the contract, the Employer may require the Tenderer to produce detailed price analysis for any or all items of the Bill of Quantities, to demonstrate the internal consistency of those prices with the construction methods and schedule proposed. After evaluation of the price analyses, the Employer may require that the amount of the performance security set forth in Clause 29 be increased at the expense of the successful Tenderer to a level sufficient to protect the Employer against financial loss in the event of default of the successful under the contract.

F. Award of Contract

26. Award criteria

26.1 Subject to Clause 27, the Employer will award the Contract to the Tenderer whose Tender has been determined to be substantially responsive to the Tender documents and who has offered the lowest evaluated Tender Price, provided that such Tenderer has been determined to be (a) eligible in accordance with the provisions of Clause 2, and (b) qualified in accordance with the provisions of Clause 3.

27. Employer's right to accept any Tender and to reject any or all Tenders

27.1 Notwithstanding Clause 26, the Employer reserves the right to accept or reject any Tender, and to cancel the Tender process and reject all Tenders, at any time prior to the award of Contract, without thereby incurring any liability to the affected Tenderer or Tenderers or any obligation to inform the affected Tenderer or Tenderers of the grounds for the Employer's action.

28. Notification of award and signing of Agreement

28.1 The Tenderer whose Tender has been accepted will be notified of the award by the Employer prior to expiration of the Tender validity period by, e-mail or facsimile or e-procurement portal or through 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").

28.2 The notification of award will constitute the formation of the Contract, subject only to the furnishing of Security deposit in accordance with the provisions of Clause 29.

28.3 The Agreement will incorporate all agreements between the Employer and the successful Tenderer. It will be kept ready for signature of the successful Tenderer in the office of Employer within 30 days following the notification of award along with the Letter of Acceptance. Within 25 days of receipt, the successful Tenderer will sign the Agreement and deliver it to the Employer.

28.4 Upon the furnishing by the successful Tenderer of the Performance Security, the Employer will promptly notify the other Tenderers that their Tenders have been unsuccessful.

29. Security deposit

29.1 Within 20 days of receipt of the Letter of Acceptance, the successful Tenderer shall deliver to the Employer a Security deposit in any of the forms given below for an amount equivalent to 5 % of the Contract Amount valid upto 28 days beyond the Defect Liability Period plus additional security for unbalanced tenders in accordance with Clause 25.5 of ITT and Clause 43 of the Conditions of Contract. For all works:

Cash or

- Banker's cheque/Demand draft,/Pay Order in favour of **The Commissioner, HDMC. Hubballi**
- - A bank guarantee in the form given in Section 10; or
- Specified Small Savings Instruments pledged to **The Commissioner, HDMC. Hubballi**
- Fixed Deposit Receipts pledged in the name of **The Commissioner, HDMC. Hubballi**

29.2 If the security deposit is provided by the successful Tenderer in the form of a Bank Guarantee, it shall be issued either by a Nationalized/Scheduled bank.

29.3 The security deposit if furnished in demand draft can, if requested, be converted to interest bearing securities at the cost of the contractor.

29.4 Failure of the successful Tenderer to comply with the requirements of Sub-Clause 29.1 shall constitute sufficient grounds for cancellation of the award and forfeiture of the Earnest money deposit.

30. Advance Payment and Security:

30.1 The Employer will provide an advance payment on the contract price as stipulated in the Conditions of Contract, subject to the maximum amount as stated in the Contract Data.

31. Corrupt or Fraudulent practices

31.1 The Government of Karnataka (GOK) requires that the Tenderers/Suppliers/Contractors, observe the highest standard of ethics during the procurement and execution of such contracts. In pursuance of this policy, GOK:

(a) will reject a proposal for award if it determines that the Tenderer recommended for award has engaged in corrupt or fraudulent practices in competing for the contract in question;

(b) will declare a firm ineligible, either indefinitely or for a stated period of time, to be awarded a GOK contract if it at any time determines that the firm has engaged

in corrupt or fraudulent practices in competing for, or in executing, a GOK contract.

31.2 Furthermore, Tenderers shall be aware of the provision stated in sub-clause 50.2 of the Conditions of Contract.

SECTION 3: QUALIFICATION INFORMATION

The information to be filled in by the Tenderer hereunder will be used for purposes of computing Tender capacity as provided for in Clause 3 of the Instructions to Tenderers. This information will not be incorporated in the Contract.

1.1	Constitution or legal status of Tenderer		
	Place of Registration	(Attach copy)	
	Principal place of business:	(Attach Copy)	
1.2	Total value of civil engineering construction works executed and payments received in the last five years (in Rs. Lakhs) **Attach Certificate from Chartered Accountant**		
		2012-13	
		2013-14	
		2014-15	
		2015-16	
		2016-17	

1.3 Work performed as Prime Contractor (in the same name) on works of similar nature over during the five years specified in 1.2 above.

Project Name	Name of Employer	Description of Work	Contract Number	Value of Contract in Rs. Lakh	Date of issue of work order	Specified period of completion	Actual date of completion	Remarks explaining reasons for delay in completion of work
1	2	3	4	5	6	7	8	9

1.4 Quantities of work executed as prime contractor (in the same name) during the last five years specified in 1.2 above:

Year	Name of Work	Name of Employer	Quantity of work performed (cum) with respect to ITT clause 3							Remarks (Indicate contract reference)
			EW	RCC/ PCC	MT	Sqm	Each	MT	Rmtr	
2012-13										
2013-14										
2014-15										
2015-16										
2016-17										

1.5 Information on works for which Tenders have been submitted and works which are yet to be completed as on the date of this Tender.

(A) Existing commitments and on-going works:

Description of Work	Place & State	Contract No. & Date	Name & Date Address of Employer	Value of Contract (Rs. Lakhs)	Stipulated period of completion	Value of works remaining to be completed (Rs. Lakhs)	Anticipated date of completion
1	2	3	4	5	6	7	8

Note: For Sl no. 7 above Attach Certificates from Engineers –in- Charge

(B) Works for which Tenders already submitted:

Description of Work	Place & State	Name & Date Address of Employer	Estimated value of works (Rs. Lakhs)	Stipulated period of completion	Date when decision is expected	Remarks if any
1	2	3	4	5	6	7

1.6 The following items of equipment are considered essential for successfully carrying out the works. The tenderer should furnish all the information listed below.

Item of Equipment	Requirement No. Capacity	Owned	Owned and available Number/Capacity Age/Condition	Remarks
(as specified in clause 3.3a)				

1.7 Reports on the financial standing of the tenderer, such as profit and loss statements and auditor's reports for the last five years;
1.8 Qualification and experience of the key technical and management personnel in permanent employment with the tenderer and those that are proposed to be deployed on this contract, if awarded.

Position*	Qualifications	Years of experience (general)	Years of experience in the proposed position
Project Manager-1Nos	Graduate in Civil Engineering	10 years	3 years
Site Engineer (Ele) -1 Nos	Graduate in Electrical Engineering	5 years	3 years
Site Supervisors-2 Nos	Diploma in Civil Engineering	5 years	2 years

1.9. Name, address, and telephone, telex, and fax numbers of the Tenderers' bankers who may provide references if contacted by the Employer.

1.10 Evidence of access to financial resources to meet the qualification requirement specified in ITT Clause3.3 (b): Cash in hand, Letter of Credit etc. List them below and attach certificate from the Banker in the suggested format as under:

BANKER'S CERTIFICATE

This is to certify that M/s. ..... is a reputed company with a good financial standing. If the contract for this work, namely ..... (*name of the work)* is awarded to the above firm, we shall be able to provide overdraft/credit facilities to the extent of Rs..... to meet the working capital requirements for executing the above contract.

Sd/-

Name of the Bank, Senior Bank Manger
Address:.....

1.11 Deleted

1.12 Information on litigations in which the Tenderer is involved:

Other Party (ies)	**Employer**	**Details of dispute**	**Amount involved**	**Remarks showing present status**
1	2	3	4	5

1.13 The proposed methodology and program of construction, backed with equipment planning and deployment, duly supported with broad calculations and quality control procedures proposed to be adopted, justifying their capability of execution and completion of the work as per technical specifications within the stipulated period of completion as per milestones.

SECTION 4: FORMS OF TENDER, LETTER OF ACCEPTANCE, NOTICE TO PROCEED WITH THE WORK AND AGREEMENT FORM

Form of Tender

Description of the Works ----------

Tender

To :
Address :

GENTLEMEN,

We offer to execute the Works described above in accordance with the Conditions of Contract accompanying this Tender for the Contract Price of

This Tender 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 tender you receive.

The advance payment required is Rs _____Lakhs

We 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 Tender complies with the Tender validity and Earnest money deposit required by the Tender documents.

We attach herewith our current income-tax clearance certificate.

Authorized Signature:

Name & Title of Signatory: _____

Name of Tenderer _____
Address: _____
_____

Letter of Acceptance
(letterhead paper of the Employer)

[date]

To

[name and address of the Contractor]

Dear Sirs,

This is to notify you that your Tender dated _____ for execution of the ---------- ----------for the Contract Price of Rupees ( ) [amount in words and figures], as corrected and modified in accordance with the Instructions to Tenderers is hereby accepted by our Agency.

You are hereby requested to furnish Security deposit plus additional security for unbalanced tenders in terms of Clause 25.5 of ITT, in the form detailed in Clause 29.1 of ITT for an amount of Rs.————— within 20 days of the receipt of this letter of acceptance valid up to 30 days from the date of expiry of Defects Liability Period i.e. up to 31 months from the date of Agreement (18 months for working period + 12 months for Defective liability period + 1 month) and sign the contract, failing which action as stated in Para 29.4 of ITT will be taken.

Yours faithfully,

Authorized Signature

Name and Title of Signatory

Name of Agency

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 security deposit as stipulated in ITT Clause 29.1 and signing of the contract agreement for the construction of **----------at** Tender Price of Rs.————, you are hereby instructed to proceed with the execution of the said works in accordance with the contract documents.

Yours faithfully,

Agreement Form

Agreement

This agreement, made the _____day of _____20_____, between .....(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 execute ---------- i.e. (hereinafter called "the Works") and the Employer has accepted the Tender by the Contractor for the execution and completion of such Works and the remedying of any defects therein at a contract price of 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) Notice to proceed with the works;
   iii) Contractor's Tender;
   iv) Contract Data;
   v) Conditions of contract (including Special Conditions of Contract);
   vi) Specifications;
   vii) Drawings;
   viii) Bill of Quantities; and
   ix) Any other document listed in the Contract Data as forming part of the contract.

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 _____

SECTION 5: CONDITIONS OF CONTRACT

Table of Contents

Conditions of Contract

A. General

1. Definitions

1.1 Terms which are defined in the Contract Data are not also defined in the Conditions of Contract but keep their defined meanings. Bold letters are used to identify defined terms.

Bill of Quantities means the priced and completed Bill of Quantities forming part of the Tender.

Compensation events are those defined in Clause 38 hereunder.

The **Completion Date** is the date of completion of the Works as certified by the Employer in accordance with Sub Clause 46.1.

The **Contract** is the contract between the Employer and the Contractor to execute, complete and maintain the Works. It consists of the documents listed in Clause 2.2 below.

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

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

The **Contractor's Tender** is the completed Tender document submitted by the Contractor to the Employer.

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

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

A **Defect** is any part of the Works not completed in accordance with the Contract.

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

The **Employer** is the party who will employ the Contractor to carry out the Works.

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

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

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

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

Plant is any integral part of the Works which is to have a mechanical, electrical, electronic or chemical or biological function.

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

Specification means the Specification of the Works included in the Contract and any modification or addition made or approved by the Employer.

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

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

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

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

2. Interpretation

2.1 In interpreting these Conditions of Contract, singular also means plural, male also means female or neuter, and the other way around. Headings have no significance. Words have their normal meaning under the language of the Contract unless specifically defined. The Employer will provide instructions clarifying queries about the Conditions of Contract.

2.2 The documents forming the Contract shall be interpreted in the following order of priority:

(1) Agreement
(2) Letter of Acceptance, notice to proceed with the works
(3) Contractor's Tender
(4) Contract Data
(5) Conditions of Contract
(6) Specifications
(7) Drawings
(8) Bill of quantities and
(9) any other document listed in the Contract Data as forming part of the Contract.

3. Law governing contract

3.1 The law governing the Contract is the Laws of India supplanted by the Karnataka Local Acts.

4. Employer's decisions

4.1 Except where otherwise specifically stated, the Employer will decide contractual matters between the Employer and the Contractor.

5. Delegation

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

6. Communications

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

7. Subcontracting

7.1 Deleted.

8. Other Contractors

8.1 The Contractor shall cooperate and share the Site with other contractors, public authorities, utilities, and the Employer.

9. Personnel

9.1 The Contractor shall employ the technical personnel (of number and qualifications) as may be stipulated by GOK from time to time during the execution of the work. The technical staff so employed shall be available at site as may be stipulated by the Employer.

9.2 If the Employer asks the Contractor to remove a person who is a member of the Contractor's staff or his work force stating the reasons, the Contractor shall ensure that the person leaves the Site within seven days and has no further connection with the work in the Contract.

10. Employer's and Contractor's risks

10.1 The Employer carries the risks which this Contract states are Employer's risks, and the Contractor carries the risks which this Contract states are Contractor's risks.

11. Employer's risks

11.1 The Employer is responsible for the excepted risks which are:

(a) rebellion, riot commotion or disorder unless solely restricted to employees of the Contractor or his Sub-Contractors arising from the conduct of the Works; or

(b) a cause due solely to the design of the Works, other than the Contractor's design; or

(c) any operation of the forces of nature (in so far as it occurs on the Site) which an experienced contractor:

(i) could not have reasonably foreseen; or

(ii) could reasonably have foreseen, but against which he could not reasonably have taken at least one of the following measures;

(A) prevent loss or damage to physical property from occurring by taking appropriate measures or

(B) insure against such loss or damage

12. Contractor's risks

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

13. Insurance:

13.1 The Contractor shall prior to commencing the works, effect and thereafter maintain insurances, in the joint names of the Employer and the Contractor, (cover from the first working day after the Start Date to the end of Defects Liability Period), in the amounts stated in the Contract Data:

(a) for loss of or damage to the Works, Plants and Materials and the Contractor's equipment;

(b) for liability of both Parties for loss, damage, death and injury to third parties or their property arising out of the Contractor's performance of the Contract including the Contractor's liability for damage to the Employer's property other than the Works and

(c) for liability of both Parties and of any Employer's representative for death and injury to the Contractor's personnel except to the extent that liability arises from the negligence of the Employer, any Employer's representative or their Employees.

13.2 Policies and certificates for insurance shall be delivered by the Contractor to the Employer for his approval before the Start Date. All such insurance shall provide for compensation to be payable to rectify the loss or damage incurred. All payments received from insurers relating to loss or damage shall be held jointly by the Parties and used for the repair of the loss or damage or as compensation for loss or damage that is not to be repaired.

13.3 If the Contractor fails to effect or keep in force any of the insurances referred to in the previous sub-clauses or fails to provide satisfactory evidence, policies or receipts, the Employer may without prejudice to any other right or remedy, effect insurance for the cover relevant to such default and pay the premiums due and recover the same as a deduction from any other monies due to the Contractor. If no payments is due, the payment of the premiums shall be a debt due.
13.4 Alterations to the terms of an insurance shall not be made without the approval of the Employer.
13.5 Both Parties shall comply with any conditions of the insurance policies.

14. Site Investigation Reports:
14.1 The Contractor, in preparing the tender, shall rely on any site investigation reports referred to in the Contract data, supplemented by any information available to the Tenderer.

15. Queries about the Contract Data
15.1 The Employer will clarify queries on the Contract Data.

16. Contractor to construct the Works
16.1 The Contractor shall construct the Works in accordance with the Specification and Drawings.

17. The Works to be completed by the Intended Completion Date
17.1 The Contractor may commence execution of the Works on the Start Date and shall carry out the Works in accordance with the program submitted by the Contractor, as updated with the approval of the Employer, and complete them by the Intended Completion Date.

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

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

20. Discoveries
20..1 Anything of historical or other interest or of significant value unexpectedly discovered on the Site is the property of the Employer. The Contractor is to notify the Employer of such discoveries and carry out the Employer's instructions for dealing with them.

21. Possession of the Site
21.1 The Employer shall give possession of all parts of the Site to the Contractor. If possession of a part is not given by the date stated in the Contract Data the Employer

is deemed to have delayed the start of the relevant activities and this will be Compensation Event.

22. Access to the Site

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

23. Instructions

23.1 The Contractor shall carry out all instructions of the Employer which comply with the applicable laws where the Site is located.

24. Procedure for resolution of Disputes:

24.1 If the Contractor is not satisfied with the decision taken by the Employer, the dispute shall be referred by either party to Arbitration within 30 days of the notification of the Employer's decision.

24.2 If neither party refers the dispute to Arbitration within the above 30 days, the Employer's decision will be final and binding.

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

B. Time Control

25. Program

25.1 Within the time stated in the Contract Data the Contractor shall submit to the Employer for approval a Program showing the general methods, arrangements, order, and timing for all the activities in the Works.

25.2 The Employer's approval of the Program shall not alter the Contractor's obligations. The Contractor may revise the Program and submit it to the Employer again at any time. A revised Program is to show the effect of Variations and Compensation Events.

26. Extension of the Intended Completion Date

26.1 The Employer shall extend the Intended Completion Date if a Compensation Event occurs or a Variation is issued which makes it impossible for Completion to be achieved by the Intended Completion Date.

26.2 The Employer shall decide whether and by how much to extend the Intended Completion Date within 21 days of the Contractor asking the Employer for a decision upon the effect of a Compensation Event or Variation and submitting full supporting information.

27. Delays ordered by the Employer

27.1 The Employer may instruct the Contractor to delay the start or progress of any activity within the Works.

28. Management meetings

28.1 The Employer may require the Contractor to attend a management meeting. The business of a management meeting shall be to review the progress achieved and the plans for remaining work.

28.2 The responsibility of the parties for actions to be taken is to be decided by the Employer either at the management meeting or after the management meeting and stated in writing to be distributed to all who attended the meeting.

C. Quality Control

29. Identifying defects

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

30. Tests

30.1 If the Employer instructs the Contractor to carry out a test not specified in the Specification to check whether any work has a Defect and the test shows that it does, the Contractor shall pay for the test and any samples. If there is no Defect the test shall be a Compensation Event.

31. Correction of defects

31.1 The Employer shall give notice to the Contractor of any Defects before the end of the Defects Liability Period, which begins at Completion and is defined in the Contract Data. The Defects Liability Period shall be extended for as long as Defects remain to be corrected.

31.2 Every time notice of a Defect is given; the Contractor shall correct the notified Defect within the length of time specified by the Employer's notice.

32. Uncorrected defects

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

D. Cost Control

33. Bill of Quantities (BOQ)

33.1 The BOQ shall contain items for the construction, installation, testing, and commissioning work to be done by the Contractor.

33.2 The BOQ is used to calculate the Contract Price. The Contractor is paid for the quantity of the work done at the rate in the BOQ for each item

34. Variations

34.1 The Employer shall have power to order the Contractor to do any or all of the following as considered necessary or advisable during the progress of the work by him Increase or decrease of any item of work included in the Bill of Quantities (BOQ);

(a) Omit any item of work;
(b) Change the character or quality or kind of any item of work;
(c) Change the levels, lines, positions and dimensions of any part of the work;
(d) Execute additional items of work of any kind necessary for the completion of the works; and
(e) Change in any specified sequence, methods or timing of construction of any part of the work.

34.2 The Contractor shall be bound to carry out the work in accordance with any instructions in this connection, which may be given to him in writing by the Employer and such alteration shall not vitiate or invalidate the contract.

34.3 Variations shall not be made by the Contractor without an order in writing by the Employer, provided that no order in writing shall be required for increase or decrease

in the quantity of an item appearing in the BOQ so long as the work executed conforms to the approved drawings.

34.4 The Contractor shall promptly request in writing the Employer to confirm verbal orders and if no such confirmation is received within 15 days of request, it shall be deemed to be an order in writing by the Employer.

35. Payments for Variations

35.1 Payment for increase in the quantities of an item in the BOQ up to 25% of that provided in the Bill of Quantities shall be made at the rates quoted by the Contractor.

35.2 For quantities in excess of 125% of the tendered quantity of an item as given in the BOQ, the Contractor shall be paid at the rate entered in or derived from in the Schedule of Rates (applicable for the area of the work and current at the time of award of contract) plus or minus the overall percentage of the original tendered rates over the current Schedule of Rates prevalent at the time of award of contract.

35.3 If there is no rate for the additional, substituted or altered item of the work in the BOQ, efforts would be made to derive the rates from those given in the BOQ or the Schedule of Rates (applicable for the area of the work and current at the time of award of contract) and if found feasible the payment would be made at the derived rate for the item plus or minus the overall percentage of the original tendered rates over the current Schedule of Rates prevalent at the time of award of contract

35.4 If the rates for additional, substituted or altered item of work cannot be determined either as at 35.1 or 35.2 or 35.3 above, the Contractor shall be requested to submit his quotation for the items supported by analysis of the rate or rates claimed, within 7 days.

35.5 If the Contractor's quotation is determined unreasonable, the Employer may order the Variation and make a change to the Contract Price which shall be based on Employer's own forecast of the effects of the Variation on the Contractor's costs.

35.6 If the Employer decides that the urgency of varying the work would prevent a quotation being given and considered without delaying the work, no quotation shall be given and the Variation shall be treated as a Compensation Event.

35.7 Under no circumstances the Contractor shall suspend the work on the plea of non-settlement of rates for items falling under this Clause.

36. Submission of bills for payment

36.1 The Contractor shall submit to the Employer monthly bills of the value of the work completed less the cumulative amount paid previously.

36.2 The Employer shall check the Contractor's bill and determine the value of the work executed which shall comprise of (i) value of the quantities of the items in the BOQ completed and (ii) valuation of Variations and Compensation Events.

36.3 The Employer may exclude any item paid in a previous bill or reduce the proportion of any item previously paid in the light of later information.

37. Payments

37.1 Payments shall be adjusted for deductions for advance payments, other recoveries in terms of the contract and taxes, at source, as applicable under the law. The Employer shall pay the Contractor the within 60 days of submission of bill.

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

38. Compensation events

38.1 The following are Compensation events unless they are caused by the Contractor:

(a) The Employer does not give access to a part of the Site by the Site Possession Date stated in the Contract Data.

(b) The Employer orders a delay or does not issue drawings, specifications or instructions required for execution of works on time.

(c) The Employer instructs the Contractor to uncover or to carry out additional tests upon work which is then found to have no Defects.

(d) The Employer gives an instruction for dealing with an unforeseen condition, caused by the Employer, or additional work required for safety or other reasons.

(e) The effect on the Contractor of any of the Employer's Risks.

(f) The Employer unreasonably delays issuing a Certificate of Completion.

(g) Other Compensation Events listed in the Contract Data or mentioned in the Contract.

38.2 If a Compensation Event would cause additional cost or would prevent the work being completed before the Intended Completion Date, the Contract Price shall be increased and/or the Intended Completion Date is extended. The Employer shall decide whether and by how much the Contract Price shall be increased and whether and by how much the Intended Completion Date shall be extended.

38.3 As soon as information demonstrating the effect of each Compensation event upon the Contractor's forecast cost has been provided by the Contractor, it is to be assessed by the Employer and the Contract Price shall be adjusted accordingly. If the Contractor's forecast is deemed unreasonable, the Employer shall adjust the Contract Price based on Employer's own forecast. The Employer will assume that the Contractor will react competently and promptly to the event.

38.4 The Contractor shall not be entitled to compensation to the extent that the Employer's interests are adversely affected by the Contractor not having given early warning or not having cooperated with the Employer.

39. Tax

39.1 The rates quoted by the Contractor shall be deemed to be inclusive of the sales and other taxes that the Contractor will have to pay for the performance of this Contract. The Employer will perform such duties in regard to the deduction of such taxes at source as per applicable law.

40. Price Adjustment: Not Applicable

41. Liquidated damages

41.1 The Contractor shall pay liquidated damages to the Employer at the rate per day stated in the Contract Data for each day that the Completion Date is later than the Intended Completion Date (for the whole of the works or the milestone as stated in the Contract Data). The total amount of liquidated damages shall not exceed the amount defined in the Contract Data. The Employer may deduct liquidated damages from payments due to the Contractor. Payment of liquidated damages does not affect the Contractor's liabilities.

41.2 If the Intended Completion Date is extended after liquidated damages have been paid, the Employer shall correct any overpayment of liquidated damages by the Contractor by adjusting the next payment of bill.

42. Advance Payments:

42.1 The Employer shall make payment to the Contractor of the amounts stated in the Contract Data by the date stated in the Contract Data, against provision by the Contractor of an unconditional bank guarantee in a form acceptable to the Employer issued by a Nationalized/Scheduled Bank in amounts equal to the advance payment. The guarantee shall remain effective until the advance payment has been repaid, but the amount of the guarantee shall be progressively reduced by the amounts repaid by the Contractor. Interest will not be charged on the advance payment.

42.2 The Contractor is to use the advance payment only to pay for Mobilization expenses required specifically for execution of the Works. The Contractor shall demonstrate that advance payment has been used in this way by supplying copies of invoices or other documents to the Employer.

42.3 The advance payment shall be repaid by deducting proportionate amounts from payments otherwise due to the Contractor, following the schedule of completed percentages of the Works on a payment basis. No account shall be taken of the advance payment or its repayment in assessing valuation of the work done, variations, price adjustments, compensation events or liquidated damages.

43. Securities:

43.1 The Security deposit (including additional security for unbalanced tenders) shall be provided to the Employer no later than the date specified in the Letter of Acceptance and shall be issued in an amount and form and type of instrument acceptable to the Employer. The Security deposit shall be valid until a date 30 days from the date of expiry of Defects Liability Period and the additional security for unbalanced tenders shall be valid until a date 30 days from the date of issue of the certificate of completion.

44. Cost of Repairs:

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

E. Finishing the Contract

45. Completion

45.1 The Contractor shall request the Employer to issue a Certificate of Completion of the Works and the Employer will do so upon deciding that the Work is completed.

46. Taking over

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

47. Final account

47.1 The Contractor shall supply to the Employer a detailed account of the total amount that the Contractor considers payable under the Contract before the end of the Defects Liability Period. The Employer shall issue a Defect Liability Certificate and certify any final payment that is due to the Contractor within 90 days of receiving the Contractor's account if it is correct and complete. If it is not, the Employer shall issue within 90 days a schedule that states the scope of the corrections or additions that are necessary. If the Final Account is still unsatisfactory after it has been resubmitted, the

Employer shall decide on the amount payable to the Contractor and make payment within 60 days of receiving the Contractor's revised account.

48. As built drawings and /or Operating and Maintenance Manuals

48.1 If "as built" Drawings and/or operating and maintenance manuals are required, the Contractor shall supply them by the dates stated in the Contract Data.

48.2 If the Contractor does not supply the Drawings by the dates stated in the Contract Data, or they do not receive the Employer's approval, the Employer shall withhold the amount stated in the Contract Data from payments due to the Contractor.

49. Termination

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

49.2 Fundamental breaches of Contract include, but shall not be limited to the following: the Contractor stops work for 45 days when no stoppage of work is shown on the current Program and the stoppage has not been authorized by the Employer;

(a) the Employer instructs the Contractor to delay the progress of the Works and the instruction is not withdrawn within 60 days;
(b) The Contractor becomes bankrupt or goes into liquidation other than for a reconstruction or amalgamation;
(c) a payment due to the Contractor is not paid by the Employer within 90 days of the date of the submission of the Bill by Contractor;
(d) the Employer gives Notice that failure to correct a particular Defect is a fundamental breach of Contract and the Contractor fails to correct it within a reasonable period of time determined by the Employer;
(e) the Contractor does not maintain a security which is required;
(f) the Contractor has delayed the completion of works by the number of days for which the maximum amount of liquidated damages can be paid as defined in the Contract data; and
(g) if the Contractor, in the judgment of the Employer has engaged in corrupt or fraudulent practices in competing for or in the executing the Contract.
(h) For the purpose of this paragraph : "corrupt practice" means the offering, giving, receiving or soliciting of anything of value to influence the action of a public official in the procurement process or in contract execution. "Fraudulent practice" means a misrepresentation of facts in order to influence a procurement process or the execution of a contract to the detriment of the Borrower, and includes collusive practice among Tenderers (prior to or after Tender submission) designed to establish Tender prices at artificial non-competitive levels and to deprive the Borrower of the benefits of free and open competition."

49.3 When either party to the Contract gives notice of a breach of contract to the Employer for a cause other than those listed under Sub Clause 49.2 above, the Employer shall decide whether the breach is fundamental or not.

49.4 Notwithstanding the above, the Employer may terminate the Contract for convenience.

49.5 If the Contract is terminated the Contractor shall stop work immediately, make the Site safe and secure and leave the Site as soon as reasonably possible.

50. Payment upon Termination

50.1 If the Contract is terminated because of a fundamental breach of Contract by the Contractor, the Employer shall prepare bill for the value of the work done less advance payments received up to the date of the bill, less other recoveries due in

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

50.2 If the Contract is terminated at the Employer's convenience or because of a fundamental breach of Contract by the Employer, the Employer shall prepare bill for the value of the work done, the reasonable cost of removal of Equipment, repatriation of the Contractor's personnel employed solely on the Works, and the Contractor's costs of protecting and securing the Works and less advance payments received up to the date of the certificate, less other recoveries due in terms of the contract, and less taxes due to be deducted at source as per applicable law and make payment accordingly.

51. Property

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

52. Release from performance

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

F. Special Conditions of Contract

General: The special conditions are supplementary instructions to the tenders and shall form part of the contract.

1 Labour:

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

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

2 Compliance with labour regulations:

During continuance of the contract, the Contractor and his sub-contractors shall abide at all times by all existing labour enactments and rules made there under, regulations, notifications and bye laws of the State or Central Government or local authority and any other labour law (including rules), regulations, bye laws that may be passed or notification that may be issued under any labour law in future either by the State or the Central Government or the local authority. The Contractor shall keep the Employer indemnified in case any action is taken against the Employer by the competent authority on account of contravention of any of the provisions of any Act or rules made there under, regulations or notifications including amendments. If the Employer is caused to pay or reimburse, such amounts as may be necessary to cause or observe, or for non-

observance of the provisions stipulated in the notifications/bye laws/Acts/Rules/regulations including amendments, if any, on the part of the Contractor, Employer shall have the right to deduct any money due to the Contractor including his amount of security deposit. The Employer shall also have right to recover from the Contractor any sum required or estimated to be required for making good the loss or damage suffered by the Employer.

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

3 Protection of Environment:

The contractor shall take all reasonable steps to protect the environment on and off the Site and to avoid damage or nuisance to persons or to property of the public or others resulting from pollution, noise or other causes arising as a consequence of his methods of operation. During continuance of the contract, the contractor and his sub - contractors shall abide at all times by all existing enactments on environmental protection and rules made there under, regulations, notifications and bye-laws of the State or Central Government, or local authorities and any other law, bye-law, regulations that may be passed or notification that may be issued in this respect in future by the State or Central Government or the local authority.

4 Arbitration (Clause 24)

4.1 The procedure for arbitration shall be as follows:

(a) In case of dispute or difference arising between the Employer and the Contractor relating to any matter arising out of or connected with this agreement it shall be settled in accordance with the Arbitration and Conciliation Act 1996. The disputes or differences shall be referred to a Sole Arbitrator. The sole arbitrator shall be appointed by the Appointing Authority, namely, Institute of Engineers, Bangalore.

(b) Arbitration proceedings shall be held at HUBBALLI, Karnataka, India

(c) The cost and expenses of arbitration proceedings will be paid as determined by the Arbitrator. However, the expenses incurred by each party in connection with the preparation, presentation, etc., shall be borne by each party itself.

(d) Performance under the contract shall continue during the arbitration proceedings and payments due the Contractor by the Employer shall not be withheld, unless they are the subject matter of the arbitration proceedings.

5 Death of a Contractor:

In the case of death of a contractor after executing / commencement of the work, his legal heir, if an eligible registered contractor and willing can executive and complete the work at the accepted tender rates irrespective of the cost of work.

6 Establishment of Field laboratory (Clause 30)

The contractor shall establish the field testing laboratory within two weeks from the date of agreement as per the details provided in Section 6: Specification

SECTION 6 : CONTRACT DATA

Items marked "N/A" do not apply in this Contract.

The following documents are also part of the Contract:	Clause Reference
The Schedule of Operating and Maintenance Manuals	[48]
The Methodology and Program of Construction	[25]
Site Investigation Reports	[14]
The Schedule of Key and Critical Equipment to be deployed on the work as per agreed program of construction.	[25]
The Employer is: **The Executive Engineer (South),HDMC. Hubballi**	[1.1]
Authorised Representative: **The Executive Engineer (South),HDMC. Hubballi**	
The name and identification no. of the Contract is "**Construction of Electrical Crematorium at Harishchandra Burial Ground in ward No.50**"	[1.1]
The identification no. of the Contact is	[1.1]
The Work consist of Please refer to Section 7: Scope and Specification	
The start date shall be the date of issue of notice to proceed with the work	[1.1]
The Intended Completion Date for the whole of the Works is **6 (SIX) Months** with following milestone:	[17, 26]

Milestone dates:	Physical works to be completed	Period from the date of issue of Notice to proceed with the work
Milestone 1	Earthwork, PCC, RCC, frame structures with a minimum financial progress of Rs 30% of contract value	2 months
Milestone 2	RCC frame structures masonry work with a cumulative financial progress of Rs 60% of contract value	4 months
Milestone 3	Installation of E&M components, finishing works, completing all works in all respects, including trial run and commissioning.	6 months

The Site Possession Date is: Date from the notice to proceed with the work.	[21]
The Defects Liability Period is two years.	[31]
The Site is located in HUBBALLI-DHARWAD City Corporation and is define d in the drawing	[1.1] Table showing list of drawing.

Insurance requirements are as under: [13]

	Type of Cover	**Minimum cover for Insurance**
(i)	Works and of Plant and materials	The sum stated in the Agreement (Contract Value) plus 20%
(ii)	Loss or damage to equipment	Full replacement cost
(iii)	Loss or damage to property of Third Party	Full replacement cost
(iv)	Personal injury or death insurance (a) for Third Party (For Two)	
	(b) for Contractor's employees or labour	In accordance with the statutory requirements applicable to Karnataka minimum of Rs. 1.00 lakh per person and insurance shall cover minimum 4 persons

The liquidated damages for the whole of the works are 0.1% of the Contract Price per day and that for the milestones area sunder:

For Milestone 1:Rs. _____ per day (30% of the 0.01% of the Contract Price per day) [41]
For Milestone 2:Rs. _____per day (30% of the 0.01% of the Contract Price per day

For Milestone 3:Rs. _____ Per day (40% of the 0.01% of the Contract Price per day
The maximum amount of liquidated damages for the whole of the works is 10% (ten percent) of final contract price is 10% (ten percent) of final contract price [41]

The amount of advance payment are ;

Nature of Advance	Amount (Rs.)	Conditions to be fullfilled
1. Mobilisation Advance	Not Applicable	Not Applicable

Repayment of advance payment for mobilization : [42]

The advance loan shall be repaid with percentage deductions from the interim payments certified by the Engineer under the Contract. Deductions shall commence in the next Interim Payment Certificate following that in which the total of all such payments to the Contractor has reached not less than 15 percent of the Contract Price or 3 (three) months from the date of payment of first installment of advance, whichever period concludes earlier, and shall be made at the rate of 7.5% percent of

the amounts of all Interim Payment Certificates until such time as the loan has been repaid, always provided that the loan shall be completely repaid prior to the expiry of the original time for completion pursuant to Clauses 17 and 26.

The date by which "as-built" drawings in 2 sets are required is within 30 days of issue of certificate of completion of Whole or Section of the Work as the case may be [48]

The date by which Operating and Maintenance Manuals are required is within 30 days of issue of certificate of completion of Whole or Section of the Work as the case may be. [48]

The amount to be withheld for failing to supply "as built" drawings or supply of Operation and Maintenance Manuals by the date required is 0.5 % of the contract value [48]

The following events shall also be fundamental breach of the contract: [49.2]

1. The contractor has contravened Sub-clause 7.1 and Clause 9 of CC.

The percentage to apply to the value of the work not completed representing the Employer's Additional cost for completing the Works shall be 30 percent. [50.1]

SECTION 7: SPECIFICATIONS

Attached separately in Volume II

SECTION 8: DRAWINGS

Attached separately in e-procurement Portal

SECTION 9: BILL OF QUANTITIES

Please refer in E-procurement portal.

Note:

(1) Item for which no rate or price has been entered in will not be paid for by the Employer when executed and shall be deemed covered by the other rates and prices in the Bill of Quantities (refer: ITB Clause 11.2 and CC Clause 37.2).
(2) Unit rates and prices shall be quoted by the Tenderer in Indian Rupees.

SECTION 10: FORMAT OF BANK GUARANTEE FOR SECURITY DEPOSIT

To: _____ *[name of Employer]*

_____ *[address of Employer]*

WHEREAS _____ *[name and address of Contractor]* (hereinafter called "the Contractor") has undertaken, in pursuance of Contract No. _____ dated _____ to execute

_____ *[name of Contract and brief description of Works]* (hereinafter called "the Contract");

AND WHEREAS it has been stipulated by you in the said Contract that the Contractor shall furnish you with a Bank Guarantee by a recognized bank for the sum specified therein as security for compliance with his obligations in accordance with the Contract;

AND WHEREAS we have agreed to give the Contractor such a Bank Guarantee;

NOW THEREFORE we hereby affirm that we are the Guarantor and responsible to you, on behalf of the Contractor, up to a total of Rs._____ *[amount of guarantee]* Rupees _____*[in words]*, and we undertake to pay you, upon your first written demand and without cavil or argument, any sum or sums within the limits of_____ *[amount of guarantee]* as aforesaid without your needing to prove or to show grounds or reasons for your demand for the sum specified therein.

We hereby waive the necessity of your demanding the said debt from the Contractor before presenting us with the demand.

We further agree that no change or addition to or other modification of the terms of the Contract or of the Works to be performed there under or of any of the Contract documents which may be made between you and the Contractor shall in any way release us from any liability under this guarantee, and we hereby waive notice of any such change, addition or modification.

This guarantee shall be valid until 30 days from the date of expiry of the Defects Liability Period.

Signature and seal of the guarantor _____

Name of Bank _____
Address _____
Date _____

Request for Proposal for Setting up

Electric crematorium - Construction and Commissioning.

Volume II: SCOPE OF WORK AND SPECIFICATIONS

1 ELECTRIC CREMATOR SCOPE OF WORK

1.1 Description: Electrically heated (resistance type) Cremation furnace (Double Chamber) along with Charging machine and latest Control unit.

1.2 Scope: Design, manufacturing, supply, Erection & commissioning and provision of the equipment's/ furnace according to its design parameters and capacity

1.3 Leading particulars: Type: Electrically operated Cremation Furnace along with charging M/C and latest Control System.

Duty: Cremation of human body maintaining the norms of pollution Control Board.

1.4 Normal Working Temperature:

Primary chamber temperature: Min 600°C Max 1100°C

Secondary chamber temperature: Design 650°C Max 1100°C

Mode of Charging : Manually operated charging Machine.

Retention time of flue In Secondary Chamber : 2 Sec at 850°C 5

Pressure -Static Under pressure main chamber -10 to -15 mm water column

Skin Temperature:

In primary Chamber : Max. 30° C above ambient.

In secondary Chamber : Max. 40°C above ambient. (The above temperature to be measured at the outer surface of the furnace)

1.5 Charging Door Operation : Electro mechanically operated rise and fall type with provision for manual operation. The operation of door will be provided with limit switches.

1.6 Control Philosophy : The heating power to be controlled from the control panel. The furnace pressure to be controlled through manually operated Damper.

1.7 The Advanced Technical Features of the Electrical Cremator include:-

- **Excellent Environmental Performance** – emissions conforming to current Standards.
- **Robust Hearth bricks** providing the main support on which body/coffin is placed.
- **Twin incineration chambers** – One primary chamber and a secondary chamber with heating elements embedded in it .
- **Shaped Refractories** - including over 40% Alumina in areas of heavy wear .
- **Robust construction** – a design capable of 8 to 10 cremations per day, and cremations times around 45 to 60 minutes fully achievable.
- **High Performance Cyclonic/Vane/Ventury type Wet Scrubber** – which cleans the smoke and ensures almost pollution free discharge through the chimney.
- **Automatic temperature control** of both primary and post combustion zones.
- **Automatic fail safe** against over temperature.
- **Compact** design, enabling easy installation.
- The design of this cremator includes a secondary chamber which is capable of maintaining the flue gases combustion temperature at 650 deg C for a residence time of greater than 1 second during operation.

1.8 Cremator General Description

The basic cremator will consist of:

- Cremator Furnace
- Combustion Air supply system
- Wet Scrubber (Vane type)
- Stack (Self supported)
- Control Panel.
- Chimney
- Manual “Dead Body” charging systems

1.9 Principle of Operation:

The cremator comprises a primary chamber of generous proportions into which the coffin /Dead Body is inserted and within which the primary combustion takes place. The Dead body/ coffin is placed on the hearth bricks, so as to keep the Body suspended in centre of the Primary chamber. The cremation of the body takes place due to Superheated Air introduced into the primary chamber and the heat transfer is mainly from the energy stored in the refractory mass. The temperature in this zone during the process of cremation can reach a maximum of 1000°C. The volatile product of combustion produced from this phase exits the primary chamber via the gaps between the hearth bricks descending below into the secondary combustion zone in which the combustion of gaseous phase takes place.

The gases entering this zone then undergo complete combustion due to the heating elements in the secondary zone and this process is assisted by the introduction of additional air. The flue gases make numerous passes within the secondary combustion zone, where the flue gas temperature is maintained at the required combustion temperature of 600-620°C.

1.10 Main Combustion Chamber

The primary chamber is equipped with **2 banks of 80-20 Ni – Cr** heating elements embedded in the side wall of the FURNACE and independently controlled air supply passes along the side wall of the cremator slightly above the hearth bricks and another passes below the grate brick. At the far end of the Hearth, through-port is provided to allow the Neutralized ashes to fall/manually scrapped through to the pivot grate and finally in the ash tray.

1.11 Secondary Combustion Zone

The cremator benefits from a specially designed secondary combustion zone, and is sufficiently sized to ensure a flue gas residence time of 1 second during operation.

The Cremator is designed with a secondary combustion zone comprising a series of passes below, **a single bank of 80-20 Ni – Cr** heating elements within this zone ensures that the temperature requirements are maintained while adequate supplies of secondary air in the flue path ensure complete combustion.

The post combustion of the flue gases is completed within these high intensity areas, eliminating all smells. The design of the post combustion chambers ensures a lengthy, complex passage through the cremator prior to the flue gas entering the scrubber system.

Residence time in secondary combustion chamber > 1 second

The secondary combustion chamber is specifically designed to ensure a flue gas residence time of 1 second at a flue gas temperature of 650 °C.

1.12 Combustion System

The primary chamber heating elements has a maximum rating of **40 kW** and this enables normal operating temperature in the range of 600°C - 700°C to be achieved in the primary chamber. **(The maximum allowable operating temperature is 1100°C).**

The secondary combustion zone heating elements has a maximum rating of **20 kW** which will enable temperatures of 650°C to be achieved in the secondary chamber.

1.13 Control Valves and Instrumentation

The controlled addition of combustion air to the combustion process is effected by 2 modulating control valves, for the control of the individual supplies to the primary and secondary chambers.

The primary chamber and secondary chamber temperatures are measured by type K thermocouples, temperatures all independently displayed on temperature instruments

1.14 Combustion Air System

The cremator installation is supplied with combustion air by a fan, with a design duty capable of providing the air pressure and flow requirements of the Cremator. The fan is located within / near the cremator.

1.15 Pollution Control device

a. Induced Draft Fan and Ducting

A suitable designed ID fan pull out the flue gases from the furnace and release it to the chimney. Before coming to the chimney it passes through the ventury packed wet scrubber, separator etc. Suitable ducting is provided in the system along with valves to carry and control the flow of the flue gas.

b. Scrubber

Dust laden gases enter into cyclo-ventury inlet from where gases mixed with water jet entered tangentially through nozzles. In separator further scrubbing takes place through cyclonic effect. Further mist eliminator is provided to reduce the water droplets enter into the blower casing.

The inlet and outlet ducting is made out of SS 304 and blower is dynamically balanced and fixed on top of the scrubber. It will suck the flue from the furnace through ventury scrubbing system an through to the outlet connected to the chimney.

Material of construction : S.S. AISI – 304

Position of water spray : from top

Water circuit : closed.

Efficiency : 95%

Nozzle : specially designed Brass made nozzle.

Concentration of particles : 150 mg/Ng (nominal cu. mtr.) in exhaust air.

Velocity of exhaust air : 1M/ sec.

Fume discharge : 1500 cu.m. per hour.

Rating of re-circulation : 2.0 H.P. pump

c. Water Circulation System

Clean water is required for spraying in the scrubber mechanism and the return dirty water is also to be stored in another tank. One recirculation tank comprises three chambers and recirculation water pump with necessary pipe fittings are considered to feed clean water from the third chamber for spraying from the top scrubber mechanism and the return dirty water is stored in the first chamber. The process of sedimentation of water and particles is done with the help of three chamber system. In this process of sedimentation the particles are mostly sediment in the first two chambers and the clean water after sedimentation is collected in the third chamber. The sediment liquid from the bottom of first chamber is drained out by means of operating valve to Soak Pit with filter bed arrangement made of with different size granules. The sedimentation tank is cleaned every week or after cremation of 60 numbers body whichever is earlier. Provision are also being kept to supply fresh water from alternate source of supply into third chamber.

d. Chimney

The chimney is self supporting MS construction having 30 mtr ht 620 mm dia at bottom , 350 mm dia at top shall be supplied along with its foundation bolts. The chimney shall be provided with copper lighting Arrestor and provision to check the emission level of the flue gas at height of 10 mtr.

The chimney shall be protected with two coats of red oxide and one coat of aluminum paint.

1.16 415 V Furnace Control Panel:

The cremator is supplied with a dedicated control panel through which the operations and process parameters are controlled. The panel is fitted with digital temperature controllers for controlling primary and secondary chamber temperatures. Pressure gauge located on the panel helps the operator understand the chamber pressure. Energy meter provided helps in analysing the total energy consumption. The operator by means of indicating lamps knows display of each Control valve position.

The control enclosure is located on the side of the cremator. Within the enclosure, all the equipment is located to minimise the effects of heat, and is adequately ventilated so ensuring trouble free operation.

The control system is capable of the total control of the cremator and all its functions in order to complete the cremation of the human body once the cremation chamber has been charged, and so simplifies the day-to-day operation of the cremator.

1.17 Cremator Process Control – Safety Features

The blind temperature controller is provided in case of failure of any of the digital temperature controller.

Electrical interlocks also prevent the charging door being opened for the introduction of a coffin/ Dead body unless the temperature in the main chamber is below the set charging level.

1.18 Cremator Construction Description

a. Casing and Framework

The casing and framework of the cremator is fabricated from steel plate and sectional steel construction. The overall external dimension of the cremator are

Length	**3.70 metres**
Width	**2.13 metres**
Height	**4.40 metres**

The total weight of the cremator is approximately **34,000 kgs.**

b. Refractory Lining

Refractories are of high quality, comprising firebrick, semi-insulating refractory and lightweight insulating refractory materials, backed by Hysil blocks insulation at the furnace casing. The firebrick used as the hot-face material for the primary and secondary chamber is a 42% alumina firebrick with a maximum working temperature of 1100°C.

In the areas of high wear, e.g. the main combustion area, hearth bricks is used which has high resistance to abrasion and thermal shock, and also a maximum working temperature of 1100°C.

c. Charge Door

The ceramic fibre lined charge door is situated at the front of the cremator and is counterbalanced and suspended on sprocket chains for ease of operation. Operation is by means of a geared electric motor controlled by push buttons situated in the control panel and interlocked to prevent charging as previously stated.

The dimensions of the charging aperture are:-

Width	**0.95 metres**
Height	**1.10 metres**
Length	**2.40 metres**

The recommended maximum size of coffin which can be inserted into the machine, is:

Width	**860 mm**
Height	**630 mm**
Length	**2200 mm**

d. Ash Removal

Access for raking is through the ash door. At the end of the cremation the door is opened manually and the ash then may be raked and removed directly via the pivot grate, into the ash container, which is positioned below the ash door. Therefore both loading of coffins/body, and de-ashing of remains are carried out at different ends of the cremator.

e. Access for Maintenance

The need for access for maintenance has been carefully considered in the cremator design, and facilities have been provided for the cleaning out of accumulations of ash in any of the chambers and flue passages, access ports being provided for this purpose.

f. External Finish

Externally, the cremators main casing is Painted with good quality heat resistant aluminium paint for thermal insulation and aesthetics.

g. Drives

Sl. No.	Name	Details of drives
1	Charging Door	0.5 HP/10 rpm geared motor, 415 V, 3 Ph sq.cage F class insulation motor.
2	Re-circulation Water Pump	0.5 HP, 2800 rpm, 220 V, 1 Ph sq. cage, F class insulation motor.
3	Induced Draught Fan motor	5 HP, 2880 rpm, 415 V, 3 Ph sq. cage F class insulation motor.
4	Combustion Air Motor	1 HP, 2800 rpm, 415 V, 3 Ph sq. cage F class insulation motor.

h. Cremation Capacity

This design of cremator is robust, and will perform up to **8-10** cremations per normal working day, however, it is fully capable of operating for extended periods beyond "normal working hours", as required.

i. Cremation emission data

Sl. No.	Name	Pollution control data to be specified by supplier	PCB Norm	Unit
1	NO2-Content		700	mg/Nm3
2	CO-Content		100	mg/Nm3
3	HCl-Content		100	mg/Nm3
4	SO2/SO3-Content		200	mg/Nm3
5	Particles		100	mg/Nm3
6	O2-Content		11	Vol.%

1.19 Earthing:

The installation shall generally be carried out in accordance with the Indian Electricity Rules 1956, as amended from time to time and in conformity with the requirement included in the Indian Standard Code of Practice for Earthing IS: 3043 -1987. Detailed calculations of earthing system design including selection of number of earth electrodes based on the soil resistivity test at site. All terminal connections for earthing shall be carried out by soldering earth strips / wires with suitable lugs. Pipe electrodes for earthing shall be made of galvanized steel of class _B' Medium quality and shall not be smaller than either 50 mm (2") or 65mm (2½") internal diameter. The length of the pipe electrode shall not be less than 3 Mtr (10') in case of 50 mm (2") dia and 2.44 Mtr (8') in case of 65 mm (2½")) internal bores. A hole shall be provided at 100 mm (4") from the top end to receive a 13 mm (½") dia galvanized bolts, nuts etc and the bottom end shall be chiseled out for penetration in the soil. Proper sizes of galvanized flat shall be connected securely on the properly cleaned surface of top end of pipe electrode by means of a 100 (4") long x 13 mm (½") dia. GI bolts, nuts and double washers. The earth lid flat / conductor shall be protected mechanically by means of a continuous length GI protection pipe of suitable dia. up to a height of 0.6 Mtr (2') above ground level and the same shall be completely filled with bitumen compound and topped up to over flowing. All galvanization shall be hot

deep quality and the galvanization thickness shall be as per latest IS specification. For each earthing station, a masonry inspection pit of size 600 mm (2') X 600 mm (2') with suitable sized CI cover, wire mesh, funnel etc shall be constructed/ provided. All electrical equipments shall be properly earthed with two number galvanized steel flat of adequate size(25‖ x 3‖ or 50‖ x 6 –) and other power distribution boards, branch distribution boards shall be earthed with 1 Sq.mm copper wire. Earthing attachment to 5 A and 15 A socket outlet shall be carried out with 1 Sq.mm copper wire. Whatever be the method of the earthing, the value of resistance to earth shall not exceed one (1) ohm.

1.20 Painting: The painting works, unless otherwise stated elsewhere, shall be applicable for the following items as follows. Various equipments inclusive of electric motors, pumps, panels, control desks and accessories All pipe work including supports, hangers All metallic duct work such as exhaust ducts including supports and hangers and other metallic works if any. All metal surfaces, after preparation of surface, shall be painted with two primer coats and two finish coats. All surfaces shall be cleaned of loose substances and foreign materials, such as dirt, rust, scale, oil, grease, welding fluxes etc in order that the primary coat is rigidly anchored to the virgin metal surfaces. The prime coat shall be applied as soon as possible after the surface preparation is complete. The procedure for surface preparation shall be solvent cleaning, hand tool cleaning, power tool cleaning, flame cleaning, blast cleaning, pickling or combination thereof as applicable. The primer coating shall be Red lead or zinc chromate. Finish paint shall generally be applied by brushing except that spraying may be used for finish coat only where brushing may damage the prime coat. Proper brushes shall be selected for specific work pieces. The brush marks shall not be left in the applied paint as far as practicable. Each coat of paint shall be allowed to dry sufficiently before application of the next coat to avoid damage such as lifting or loss of adhesion.

2 Electrical Scope:

2.1 The scope of services covers the design, detailed engineering, preparation of construction drawing, manufacture, acceptance testing at manufacturer's works or at any accredited agency, supply, packing, forwarding and delivery from manufacturer's works/ place of storage to erection site including transit insurance, unloading, storage at site, assembly, erection, testing, installation, commissioning & performance demonstration and handing over along with all necessary spares of original ratings & specifications on Design, Build & Operate basis. Inland and overseas transit insurance, transport, testing at site shall be Contractor scope. Tender BOQ and drawings are for reference purpose only which is the minimum requirements; Contractor to ensure that design & equipments are as per specification requirements.

2.2 The Contractor shall prepare design calculations based on parameters/ design criteria indicated in the specifications. The Contractor shall prepare detailed engineering and construction purpose drawings to make his/ her own estimate of ratings & quantities (minimum requirements as per price schedule, technical data sheets, reference electrical Single Line Diagram & other relevant details) for entire electrical systems including all items, systems such as equipments, power & control cables/ cabling system, lighting system, earthing, lightning protection, main & auxiliary power distribution, instruments, civil works required for completion of Works.

2.3 Contractor shall take due care of the site Seismic conditions while design of all equipments/ components used in entire electrical & instrumentation systems covered in this specifications. Contractor shall furnish list of additional design parameters considered in design to fulfill above requirement.

2.4 Design and detailed engineering of the materials procured by Contractor is included in scope. Contractor shall submit each document/ calculations of system which is included in scope to Purchaser/ Consultant for final review/ approval. All design documents/ calculations prepared by Contractor shall be with ISO documentation i.e. with duly singed by qualified authorities and stamped. Design documents/ calculations prepared by sub-Contractors shall be approved by Contractor and stamped copy of approval along with no-deviation sheet from sub-contractor shall be submitted by the Contractor to Purchaser/ Purchaser's representative for final review/ approval.

2.5 Expert or manufacturer supervision for sub-contractor supplied material shall be provided by Contractor and included in offer.

2.6 Contractor shall be solely responsible for any shortages or damages in transit for his supply scope, handling and/ or in storage of any materials and erection of the equipment, supply of erection tools at site. Contractor shall ensure that it will not affect any activity or project schedule. Any demurrage, wharfage and other such charges claimed by the transporters, railways etc. shall be to the account of the Contractor.

2.7 Contractor shall identify activities and mile stones of the work forecasted for next month with optimistic and pessimistic dates of work completion. Contractor shall prepare program evaluation and review techniques to identify critical path of project and activity sequences. The project schedule shall be prepared and updated fortnightly in MS Project.

2.8 Nothing in this specification shall be constructed to relieve the Contractor of his/ her responsibilities towards following best engineering practices established in the country.

2.9 The Contractor's scope shall also include measurement of soil resistivity at site by Wenner's four electrode method as per IS: 3043 – 1987 at minimum four locations at site. The earthing shall be designed for the actual mean soil resistivity value obtained.

2.10 Even if all components of a system included in this specification are not explicitly identified and/ or listed herein, these shall be supplied under this contract to ensure completeness of the system and facilitate proper operation and easy maintenance of the plant. Any and all other works not indicated above but necessary/ required to complete the job in all aspects, are included in the Contractor's scope.

2.11 The Contractor shall include start up spares, essential spares, recommended spares and a set of special tools necessary for operation, routine maintenance of equipment supplied for a period of five years.

2.12 Contractor should visit site and get himself/ herself ascertained regarding the scope of work for the complete Electrical & Instrumentation works before submission of quote/ offer.

2.13 Contractor's scope shall include design, engineering, manufacture, supply, testing, commissioning and handover of following electrical equipments/ systems as per tender specifications, BOQ and reference electrical SLD & other relevant details.

2.14 Tariff metering equipment & electric supply connection shall be provided by HESCOM for which necessary liaison shall be done by Contractor.

2.15 11KV Two pole structure (along with necessary earthing, fence and gate) with 11kV GOD (including operating handle and lock), 9 kV Lightning Arrestors and Drop Out Fuses (wherever applicable for transformer(s) being fed directly from Two/ Four pole structure) for the 11kV power supply obtained through 11kV transmission line/ cable.

2.16 11kV/ 0.433kV Oil type, ONAN, Dyn11, pole mounted Distribution Transformers with OCTC/ OLTC + RTCC, AVR, Marshalling box.

2.17 Cabling system shall consists of various 11 kV(E)/ 1.1 kV grade, XLPE/ PVC insulated, multi-stranded Al/ Cu, GI round wire/ flat strip armoured power, control & instrumentation cables, GI ladder/ perforated type Cable Trays & associated accessories including support structures.

2.18 Non Segregated Bus Duct where applicable if transformers rating is ≥ 1000 kVA.

2.19 Provision for Continuous Monitoring of Electrical Power & Energy Parameters like Voltage, Current, Power Factor, Frequency, Kilo Watts, Kilowatt-hours etc.

2.20 Earthing for HV / LV equipments and lightning protection system for all buildings in the Intake well, Pumping stations & all the locations. The general design shall be on the basis of following codes and standards (their latest amendments) in line with design criteria & specification requirements.

a)	IS 3043-2007	:	Code of practice for Safety Earthing
b)	IS 2309-1989	:	Code of practice for the protection of buildings and allied structures against lightning.
c)	CEA guidelines 2010	:	Measures related to safety & electric supply

2.21 Lighting system for all indoor & outdoor areas of Pumping stations. The lighting system will be controlled by lighting panels installed in respective plant/ station areas, which will be fed from the main lighting DB.

3 PROJECT INFORMATION:

3.1 Site/ Environmental Conditions:

3.2 Ambient temperature : 45°C.(site specific)

3.3 Relative Humidity : 95%

3.4 Area Classification : Non Hazardous / Hazardous

3.5 Seismic Data : As per IS 1893 latest issue

3.6 Nominal System Voltage:

3.7 Incoming supply : 11 KV, 3 ph, 3 wire, 50 Hz AC

3.8 Plant power distribution supply: 415V, 3 ph, 4 wire, 50 Hz, AC

3.9 General lighting & space heating: 240V, 1 ph, 2 wire, 50Hz, AC

3.10 Control, protection & emergency lighting: 24 or 30 or 110V, 2 wire DC (as applicable)

3.11 Potential transformer secondary: 110 V, 3 ph, 50 Hz, AC

3.12 Voltage variation:

a. 11 kV supply : ± 10%

b. 415 V supply : ± 10%

3.13 Frequency variation : ± 3%

3.14 Combined voltage and frequency variation : ±10%

3.15 System Earthing:

a) 11 kV, 3 ph AC system : Neutral solidly earthed

b) 415 V, 3 ph, AC system : Neutral solidly earthed

c) 240 V, 1 ph, AC system : Neutral solidly earthed

4 This section provides brief description of the electrical power supply requirement and other electrical works for the proposed electric crematorium at harish Chandra ghat, in accordance with Indian standard code specifications, which include the following equipment and systems:

a) Power Supply Arrangements.
b) 11/0.433 kV Distribution Transformer
c) Low Tension (LT) system – 415 V Low Voltage Distribution Board (LVDB)

d) Distribution Boards for Lighting and Receptacle (L+ PDB),
e) LT Power and Control Cables and Cable carrier system
f) Illumination system
g) Earthing & Lightning Protection.

- Provision of incoming power supply to cremator building from nearest power source of HESCOM.
- Internal Electrical works:

- Cabling works-
    a. Transformer to LV switchboard.
    b. LV switchboard to Furnace control panel.
    c. LV switchboard to Lighting distribution Board.
- Building electrical works:
    a. Lighting works including luminaires, wiring, conduiting, etc.
    b. Earthing and lightning protection works of cremator building .
    c. Electrical works pertaining to electric cremator.

4.1 Design Concept

- The design concept of electrical system as a whole shall be based on providing safe, reliable & stable power and efficient performance of electrical system.
- The design standards described herein are generally in compliance with the latest Indian Standards and code of practices already established in the country.
- All electrical installations shall conform to the latest Central Electricity Authority Regulations 2010.
- The design ambient temperature for all electrical equipment shall be 50°C.

4.2 Transformer Sizing/ selection:

a) The capacity of the transformers will be calculated based on the total simultaneous maximum demand (calculated based on the load factors and diversity given above, PF, efficiency).

b) Additional 10% contingency shall be considered for deriving transformer sizing.

c) Similarly, after consideration of 10% contingency over maximum demand (MD), sizing of the selected transformer shall be such that maximum transformer loading shall not exceed 80% (of the MD + 10% Contingency) load.

4.3 Switchgear Sizing/ Selection: Switchgear shall be sized/ selected considering the following:

i. Rating suitable for carrying full load current of the equipment.

ii. Suitability for Short Circuit Rating for 1 sec duration.

iii. Switchgear for motors shall be suitable for motor duty application.

4.4 Bus Bar Sizing:

d) The Contractor shall furnish calculations after award of contract, establishing the adequacy of the bus bar sizes to meet the continuous and short time current ratings as calculated.

e) The bus-bars shall be sized considering the following criteria:

a) Sleeving made of insulating material on all bus bars.
b) Design ambient temperature 50 Deg C.
c) Final temperature of the bus-bars complying with requirements of IS 8623 & IEC 60947. Reduced temperature rise limit by 5K (for indoor panels) & 10K (for outdoor panels) to that of mentioned in IS 8623 & IEC 60947 shall be considered to satisfy the final temperature.
d) Bus bars being inside the panel; De- ration for enclosure and ventilation.
e) Bus bar suitability for carrying rated current continuously.
f) Configuration of bus bars and Proximity effect

Bus bars shall withstand the short time rating of the panel for 1 sec duration

4.5 Power Supply Arrangement

4.5.1 PRIMARY POWER SOURCE

- 11 KV power supply to the proposed system shall be tapped from the nearest HESCOM feeder.

  Power supply from overhead line shall be terminated on Double pole structure with gang operating switch along with lighting arrester.
- 11 KV Power from double pole structure shall be taken to transformer primary through 11KV underground cable.
- Transformer of 100kva is proposed based on load list of the electrical crematorium, indicated in Annexure-1
- 415V power supply from transformer secondary shall be provide to 415v Main distribution panel of electric crematorium through LT underground cable.

4.5.2 Tariff metering equipment:

- Tariff Metering equipment (suitable for 11/ 0.415 kV system) including combined CT/PT metering unit as per HESCOM standards & specifications shall be provided by HESCOM. However, Contractor will have to do all laison for obtaining approval including load sanction/ release from HESCOM, No Objection Certificates from HESCOM, Electrical Inspector (CEIG), relevant government agencies, statutory authority, as applicable is included in Contractor's scope.

4.5.3 11kv two pole structure :

- The design, material, construction, manufacture and testing of 11KV two/ four pole structures shall comply with all currently applicable statutes, regulations and safety codes in the locality where the equipment will be installed. The equipment shall also conform to the latest applicable standards.
- Two pole structures shall conform to the latest applicable standards specified as under. In case of conflict between the standards and this specification, this specification shall govern.
- Two pole structures shall be erected in switchyard to receive 11 KV power supply from power supply authority.
- Each two pole structure shall be inclusive of items listed below.

4.5.3.1 Structure:

a) A two pole structure shall be of a rolled steel joist of minimum ISMB 150 (150mm x 75mm) for 6 meter pole / ISMB 175 (175 mm x 90 mm) for 9/ 11meter pole with 400 mm x 400 mm x 8 mm thick base plate welded at bottom end of all the poles of structure.

b) Mild steel cross members of minimum ISMC 100 mm x 50 mm x 6 mm size channels of 3.5 mtr in length, 8 Nos. shall be provided with cross bracing angles of minimum ISA 50 mm x 50 mm x 6 mm size of 4.5 meter in length.

c) Side clamps, stay clamps, cleats etc. shall be fabricated from minimum 50 mm x 6 mm size MS flats as per actual requirements. All bolts, nuts, washers, etc. shall be of minimum 15 mm size.

d) All the members of two/ four pole structure should be galvanized.

e) Excavation of pits even in hard soil shall be done up to a depth of about 1/ 6 the length of pole and refilling the same after erection of structure and concreting work. Compacting the bottom of pits, providing cement concrete to suit at bottom and side of poles up to at-least 150 mm above FGL curing and making it hard as per requirement.

f) Erection of RSJ poles and fixing of all structural members as per requirement shall be in line, level and properly facing the incoming and outgoing lines. Cross members shall be firmly tightened.

g) All members shall be fabricated to suit mounting/ fixing of Gang Operated Disconnectors/ Isolators, Lightning Arrestors, Pin/ Post insulators, cable end termination Kit/ Box etc.

h) All MS parts shall be painted with two coats of red oxide and two coats of aluminum paints.

i) Earthing terminals shall be provided by welding 15 mm size bolts or cleats of 50 mm x 6 mm size MS flat shall be welded in each joist with a hole of 15 mm size and galvanized nuts, bolts, washers shall be provided as earthing terminals.

j) Necessary hardware as required for completeness shall be supplied and erected.

k) All drawings / documents such as GA drawing of two/ four pole structure showing all equipment mounted on the structure, technical particulars & Bill of Material etc shall be prepared and submitted to Purchaser/ Purchaser's representative for approval. Obtaining the approval from HESCOM and getting power released from supply authority are also included in the scope of work.

4.5.3.2 **Gang Operated Offload Disconnectors (GOD) with Earth Switch:**

a) The double break type isolator (GOD) shall be manually operated and suitable for the specified site conditions and shall be able to-

i. Carry rated current without excessive temperature rise.
ii. Withstand the short circuit forces developed during fault.
iii. Carry the inrush current of the transformer.
iv. Interrupt small inductive and capacitive currents.

b) The operating rod shall be extended up to the operating level and shall have a handle with 'lock and key' arrangement. The operating handle shall be at a level of 1.0 meter from finished ground level.

c) The operating handles shall be mounted on the base of supporting structure. Guide bearings shall be provided if necessary at appropriate height above ground level. Necessary accessories viz. brackets, angles, guides, guide bearings for attaching the operating mechanism and operating handles to the structure and part of the isolator, rust proof pins, ball or roller type bearings shall be provided and installed. All bearings shall be protected by means of covers and grease retainers. Bearings pressure shall be kept low to ensure long life and ease of operation.

d) The operating mechanism design shall be such that, as soon as the moving blades reach the sparking distance during operation of isolator, springs shall take over to give a quick snap action closing so that the isolator closing is independent of manual effort. Similarly the springs must assist during opening operation to give quick breaking feature.

e) All copper parts shall be Silver or Tin plated. All ferrous parts shall be hot dipped galvanized to assure long protection against tropicalised weather.

f) The contacts shall be of silver faced copper ensuring sufficient contact pressure. The male and female contacts shall be of self aligning type to ensure trouble free operation during opening and closing of isolator. Mild steel arcing horn capable of breaking the magnetizing current shall be provided. Earth mesh below GOD to be provided

4.5.3.3 **Isolator Mechanical Interlock:**

g) Electrical interlock arrangement shall be provided among double break bus isolator (GOD) and respective 11 KV indoor type breakers.

h) Interlocking arrangement shall be robust, heavy-duty type and sturdy in construction.

i) Mechanical interlock between isolator & Earth switch shall be provided.

4.5.3.4 **Insulators:**

a) Insulator shall be properly glazed with smooth surface without cracks etc. and dielectric property shall be properly co-ordinated with isolator voltage class. Porcelain used for the manufacturer of insulator shall be uniform, brown color, free from blisters, burns and other similar defects. Insulators of the same rating and type shall be interchangeable.

b) Porcelain and metal parts shall be assembled in such a manner that any thermal expansion differential between the metal and porcelain parts throughout the range of the temperature variation shall not loosen the parts or create undue internal stresses which may affect the electrical or mechanical strength and rigidity. Each cap and base shall be of high grade cast steel or malleable steel casting and they shall be machine faced and smoothly galvanized. The cap and base of the insulators shall be interchangeable with each other.

4.5.3.5 **ACSR Conductor:**

a) Aluminum conductor steel reinforced shall be hard drawn from 99.5% pure electrolytic aluminum rods. The Contractor shall specify the conductivity.

b) Chemical composition of the material shall comply with the requirements of relevant standards.

c) The surface of conductor shall be clean and dry and free from any excess grease that may be used in its fabrication. The surface strands shall be smooth and free from burrs and other projections which may be a cause for increasing corona losses.

d) The Contractor shall provide necessary treatment for the bus conductor to make it free from corrosion.

e) The steel wire strand of conductor and steel conductor shall be hot dip galvanized. Zinc coating shall be evenly and uniformly for heavily coated wires.

f) The steel core and inner layer of aluminum wires where more than one aluminum layer exist shall be protected with special grease in order to provide additional protection against corrosion due to salinity. The grease shall fill the whole space between wires within circumscribed cylinder at inner aluminum layer or at steel core if the conductor has only one aluminum layer.

g) The grease shall be chemically neutral with respect to aluminum, zinc and steel. It shall withstand weather conditions given elsewhere and temperature of 85 degree centigrade without alternation of its properties.

h) Bare conductor shall be covered in Alkathene pipes of suitable insulation to avoid accidental contact.

4.5.3.6 **Drop Out (DO) Fuse Unit:**

a) Drop Out Fuse shall be of approved make suitable for 11 kV supply and shall be mounted on two pole structure complete with 3 fuse elements of required ampere suitable for continuous current rating and shall offer protection against fault level of suitable ampere at 11 kV.

b) The fuse link shall consists of iron channel base to stack insulators per phase, fuse carrier Bakelite tube, heavy duty non-ferrous metal parts and spring loaded phosphor bronze contacts.

c) The insulator shall comply with impulse voltage in accordance with relevant IS.

4.5.3.7 **Station Class Lightening Arrestors:**

a) The design, material, construction, manufacture, inspection and testing of lightning arresters shall comply with all currently applicable statutes, regulations and safety codes in the locality where the equipment will be installed.

b) In case of conflict between the standards and this specification, this specification shall govern.

c) The equipment covered in this specification shall conform to the latest edition of the following standards.

IS: 3070 (Part-3)	Lightning arresters for AC system – Specification (Metal Oxide Lightning Arrester without Gaps)
IEC: 60099-4	Metal Oxide surge arresters without gaps for AC system

4.5.3.8 **Constructional Features:**

d) Lightning arrester shall be station class heavy duty and non- linear resistance type. The elements shall be in hollow cylindrical form, stacked together. Lightning arrestor shall be of class II, having non – linear voltage – current characteristic and having high discharge capability.

e) The entire arrester unit shall be housed in a porcelain insulating casing of high strength, made from brown glazed wet process porcelain, with metallic cover plates and terminal assemblies. The end castings shall be hermetically sealed and leak tested to protect the unit from moisture or breathing.

f) Pressure relief diaphragm, vent pipe, etc. shall be provided on the LA for the escape of gases formed. In the event of failure of L.A., the pressure relief directional aperture should be directed away from adjacent apparatus to prevent damage, due to arc transfer.

g) All hardware such as clamps, screws, bolts, nuts, washers etc. shall be electro galvanized.

4.5.3.9 **Insulators:**

h) The porcelain insulators used shall be made from wet process, and shall be homogenous, free from lamination, cavities and other flaws, which may impair its mechanical or dielectric strength. They shall be thoroughly vitrified, tough and impervious to moisture.

i) The glazing of porcelain shall be uniform brown colour, free from blisters, burns, cracks and other defects. The glazing shall cover all the porcelain part of the insulators except that area which serves as support during firing or are unglazed for the purpose of assembly.

j) The minimum creepage distance shall be as stipulated in data sheets. The petticoats shall be spaced for natural cleaning action by wind and rain and avoid concentrated hot spots where local stress can precipitate flashover.

k) All live metallic parts shall be suitably painted. All joints shall be fluid – tight and air tight. The design of insulators shall be such, as to produce uniform compression pressure joints.

l) All insulators of identical rating shall be interchangeable.

m) Each bushing shall be provided with aluminum/ bimetallic terminal connectors suitable for inter – connection with aluminum tubular Bus bars or ACSR conductor as specified in data sheet.

4.5.3.10 **Accessories:** Each lightning arrester shall be furnished complete with the accessories as listed below:

n) Anti – contamination and pressure relief diaphragm complete with vent pipe.

o) Two (2) grounding pads.

p) Base plate suitable for mounting on G.I. / steel structure or concrete structure.

q) Line side terminal suitable for specified conductor.

r) Other standard accessories which are not specifically mentioned but are usually and provided with lightning arrester of similar type and rating for efficient and trouble free operation.

s) Name plates fixed on lightning arresters giving full technical details.

t) The clamps and connectors on arrestor terminals for connection to Purchaser's line conductor and the connection between incoming transmission line and LA will be in the Contractors scope.

4.5.3.11 **Drawings/ documents to be furnished for Purchaser's approval:**

i. Technical Particulars
ii. GA drawing of LA indicating weight and overall dimensions
iii. GA drawing of insulating base, discharge counter, terminal assembly
iv. Bill of Material
v. Mounting arrangement (base plate details) on the structure
vi. QAP for Lightning Arrester

4.5.3.12 **Chain Link Fencing and Gravel Filling:**

a) The work of erecting chain link fencing includes excavation, brick wall construction, erection of angle/ channel supports, providing chain link mesh on angle/ pipe frame barbed wire fencing at the top, concreting of support members, painting the complete structure and white washing the walls. All materials, hard wares, labours etc. are in the scope of contractor.

b) Fencing height shall be minimum 2.0 meter & shall be complying with CEA guide lines requirements.

c) Gate for entry in the fenced compound shall be fabricated from pipes of heavy duty class. Design of gate shall be got approved from the engineer in charge before starting the fabrication work. All necessary hard wares, fittings, stoppers, locking arrangements with brass pad locks of 100 mm size are in the scope of gate works. Gates shall be self supporting type.

4.5.4 TRANSFORMER

- One no. 100 KVA, 11 KV / 0.433 KV, DYn 11, oil cooled, energy efficient oil Type Distribution Transformer to be manufactured shop tested, supplied, erected, tested & commissioned generally in conformity with latest revision of IS. The transformers shall be suitable for outdoor installation. The transformer shall be suitable for operation at full rated power on all tappings without exceeding the following temperature rise.
- The transformer shall have off-circuit tap changer in H.T. winding in steps of 2.5% for range – 5% to +5%. The transformers shall be Delta/ Star connected with effectively earthed Star point on the secondary side. The primary and secondary terminals will be brought to the bushings for ease of termination of conductors and cables/ bus duct respectively.
- The transformer shall be designed to be capable of withstanding, without injury, the thermal and mechanical stress of short-circuits between phases or between phase and earth at the terminals of any winding with full voltage applied across the other winding. The transformers shall be capable of withstanding specified through fault currents for 2 seconds.
- The transformers shall operate with minimum noise and vibration. The cores, enclosure / protective housings and other structural parts shall be properly constructed and windings properly braced so that the mechanical vibration is kept to the minimum, thus reducing noise. The core-coil assembly shall be fixed in such a manner that no shifting or deformation occur during shipment or installation. Audible sound levels (decibels) at rated voltage and frequency for liquid immersed distribution transformer shall be as below (NEMA Standards)

kVA rating	Audible sound levels (decibels)
51-100	51

- The transformer shall be designed for minimum no-load losses within the economic limit. All mechanism shall be of stainless steel, bras, gunmetal or other suitable material to prevent sticking due to rust or corrosion. If any temporary fitting is fixed to the enclosure / protective housing of a transformer for transporting / handling purposes, these shall be identified as well as instructions and illustrated drawings shall be furnished to facilitate their removal at site after erection.
- The enclosure of the transformer shall be such that the H.T. cable termination can be done inside the enclosure and the L.T. cable inside a cable box assembly having disconnecting chamber.

- For the pole mounted transformers (i.e. transformers ≤ 100 kVA, 11/ 0.433 kV rating), suitable orientation of HV porcelain bushings shall be ensured for direct termination of ACSR conductor from 11 kV Double Pole Structure.
- Ambient temperature of 50°C shall be considered for transformer design. Temperature rise shall be 40°C for Oil temperature and 45°C for winding temperature. Hot spot temperature limits shall be complying with IS 1180, IS 2026, IS 6600 & IEC 60076-2:1993 & it shall be limited to 98 Deg. C.

4.5.4.1 **Standard:**

The materials shall conform in all respects to the relevant Indian/International Standards, with latest amendments thereof unless other wise specified herein. Some of them are listed below:

Indian Standard	**Title**	**International and internationally recognized standards**
IS:2026/1977 (Parts 1 to 5)	Specification for Power Transformers	IEC:76
IS:1180 (Part 1):2014	Outdoor distribution transformer up to and including 2500kva	
IS:12444	Specification for copper rod	ASTM B-49
IS:335/1993	Specification for transformer Oil	BS148, D-1473, D1533-1934, IEC Pub 296
IS:5/1944	Specification for colours for ready mixes colours	
IS:104/1979	Ready mixed paint, brushing zinc chromate, priming	
IS:2099/1986	Specification for high voltage porcelain bushing	
IS:649/1997	Testing for steel sheets and strips and magnetic circuits.	
IS:4257	Dimensions for clamping arrangements for bushings	
IS:7421	Specification for low Voltage bushings	
IS:3347 (Parts I to IV)	Specification for Outdoor Bushings	DIN 42531 to33
IS:5484	Specification for Al Wire rods	ASTM B:233
IS:9335	Specification for Insulating Kraft Paper	IEC 554

IS:1576	Specification for Insulating Press board.	
IS:6600	Guide for loading of oil Immersed Transformers	
IS:2362	Determination of water content in oil for porcelain bushing of transformer, by Karl fischer method-test method	
IS:6162/1971 (Parts I & II)	Paper covered aluminium conductor.	
IS:6792/1992	Determination of electrical strength of insulating oil.	
IS: 10028	Selection, installation & maintenance of transformers	
IS 13730	Specification for winding wires	

Materials conforming to other internationally accepted standards, which ensure equal or better quality than the standards mentioned above, would also be acceptable. In case the bidders who wish to offer material conforming to other standards, the bidder shall clearly bring out the salient points of difference between the standards adopted and the specific standards in relevant schedule. Five copies of such standards with authentic English translations shall be furnished along with the offer.

4.5.4.2 **SERVICE CONDITIONS:**

The materials used to manufacture of Distribution Transformer to be supplied against this specification shall be suitable for outdoor satisfactory continuous operation under the following climatic conditions. a. Ambient Air Temperature - 5°C to 50°C b. Relative Humidity - 0 to 100% c. Altitude - A height above sea level not exceeding 1000m (3300ft).

4.5.4.3 **SYSTEM DETAILS:**

The transformers shall be suitable for outdoor installation with 3Phase, 50 Hz, 11kV System in which the neutral is effectively earthed and the same shall be suitable for service under fluctuations in supply voltage up to 12.5% permissible under Indian Electricity Rules and the frequency variation of -5% and +2% (47.5Hz to 51.0Hz).

4.5.4.4 General Constructional Features of Transformer:

All material used shall be of best quality and of the class, most suitable for working-under the conditions specified and shall withstand the variations of temperature and atmospheric conditions, overloads, over-excitation, short-circuits as per specified standards, without distortion or deterioration or the setting up of undue stresses in any part, and also without affecting the strength and suitability of the various parts for the work which they have to perform. The transformer construction shall be suitable for seismic data (as per latest edition of is 1893) or elsewhere in the specification.

4.5.4.4.1 Tanks:

i. The exterior of tank and other steel surfaces exposed to the weather shall be thoroughly cleaned and have a priming coat of zinc chromate applied. The second coat shall be of an oil and weather-resistant nature, preferably of distinct colour from the prime and finish coats. The final coat shall be of a flossy, oil and weather resisting non-fading paint of specified shade. The interior of the tank shall be cleaned by shot blasting and painting with two coats of heat resistant and oil insoluble paint.

ii. Steel bolts and nuts exposed to the atmosphere shall be galvanized.
iii. Vacuum & Pressure Tests
iv. Various Vacuum & Pressure Tests for tank, conservator, radiator, pipes etc. shall be as per mentioned in the CBIP Manual on Transformer – Publication no. 317: 2013 & latest edition thereof.
v. The material used for gaskets shall be cork neoprene or approved equivalent.

4.5.4.4.2 Core

vi. The magnetic circuit shall be constructed from high grade cold-rolled non-ageing grain oriented silicon steel of 23ZDMH85 or superior to that laminations and shall be of 'core' type.
vii. The insulation structure for the core to bolts and core to clamp plates shall be such as to withstands BIL & Lightning Impulse Voltage
viii. Each lamination shall be coated with insulation which is unaffected by the temperature attained by the transformer during service.
ix. Core laminations shall be annealed and burrs removed after cutting. Cut edges shall be insulated. The maximum thickness of core laminations shall not exceed 0.3mm. Further the lamination sheets used for top yoke, bottom yoke etc., shall be of single piece.
x. The transformers core shall be suitable for over fluxing (due to combined effect of voltage and frequency) up to 12.5% without injurious heating at full load conditions and shall not get saturated. The bidder shall furnish necessary design data in support of this situation.
xi. No-load current shall not exceed 3% of full load current and will be measured by energising the transformer at 433 volts, 50Hz on the secondary. Increase of

voltage of 433 volts by 12.5% shall not increase the no-load current by 6% (maximum) full load current.

xii. The minimum (1) Effective core area (2) Number of core steps (3) Internal clearance shall be furnished by the bidder along with the bid offer.
Minimum effective cross sectional area of the core to be provided is as follows:
1) 100KVA - 84.60 sq.cm.

xiii. The unbalance current in the neutral shall not be more than 2% of the rated current.

xiv. M.S.Channel 75 x 40mm for 100 KVA and below transformers on top and bottom shall be used for clamping the core.

xv. 2 Nos. of 12mm high tensile vertical bolts in parallel in each side shall be provided. The size of the Bolts to be provided in parallel is as follows: a) 100KVA - 2 Nos. of 12mm High Tensile Bolts.

xvi. Core mounting is to be done with ISF 50x10 for Transformers up to and including 100KVA transformer.

4.5.4.4.3 Windings

xvii. Windings shall be of electrolytic grade Copper of 99.9% purity unless specifically approved by the Purchaser.

xviii. The nominal HV winding cross section shall be 2.270 sq.mm & nominal LV winding cross section shall be 83.08 SQ.MM.

xix. Current density for HV and LV winding should not be more than 1.6 Ampere per sq mm for aluminium conductor.

xx. Inter layer insulation shall be Nomex/Epoxy dotted Kraft Paper.

xxi. Windings shall be of insulated Copper wire or Copper strip.

xxii. Windings and insulation shall be so arranged that free circulation of oil is possible between coils, between windings, and between winding and core.

xxiii. Winding shall be subjected to a shrinking and seasoning process, so that no further shrinkage occurs during service.

xxiv. The completed core and coil assembly shall be dried in vacuum and shall be immediately impregnated with oil after the drying process to ensure elimination of air and moisture within the insulation.

xxv. High voltage end-windings shall be suitably braced to withstand short circuit stresses and stresses caused up by surges.

xxvi. Materials used in the insulation and assembly of the windings shall be insoluble, non- catalytic and chemically inactive in the hot transformer oil, and shall not soften or be otherwise affected under the operating conditions.

xxvii. Varnish application on coil windings may be given only for mechanical protection and not for improvement in dielectric properties. In no case varnish or other adhesive be used which will seal the coil and prevent evacuations of air and moisture and impregnation by oil.

xxviii. Permanent current carrying joints in the windings and leads shall be welded or brazed. Clamping bolts for current carrying parts inside oil shall be made of oil resistant material which shall not be affected by acidity in the oil. Steel bolts, if used, shall be suitably treated.

xxix. Terminals of all windings, and if stated also of stabilizing windings, shall be Brought out of the tank through bushings for external connections.
xxx. Windings shall be of copper and the conductors shall be transposed at sufficient intervals in order to minimize eddy currents and equalize the distribution of currents and temperatures along the windings.
xxxi. The sequence and orientation of HV/LV side phase and neutral bushings shall be as specified in the latest edition of relevant IS.
xxxii. Transformer shall operate without injurious heating at the rated KVA and at any voltage up to ± 10 % of the rated voltage of any tap. Transformer shall be designed for 110 % continuous over-fluxing withstands capability.

4.5.4.4.4 Oil:

The insulating oil shall comply with the requirements of IS:335 or BS:148. Use of recycled oil is not acceptable. The specific resistance of the coil shall not be less than 2.5x 10 12 ohm-cm at 27°C when tested as per IS 6103. Oil shall be filtered and tested for break down voltage (BDV) and moisture content before filling. The oil shall be filled under vacuum. The transformer shall be supplied complete with first filling of oil and tile same shall comply with IS: 335/1993 with latest revisions thereof Page 6 of 37 and ageing characteristics specified.

The important characteristics of the transformer oil after it is filled in the transformer (with in 3 months of filling) shall be as follows.

SL. No.	Characteristics	Requirements
1	Electric Strength	50kV Min. With 2.5mm Gap
2	Dielectric dissipation factor (Tan delta) at 90°C	0.01 Max
3	Specific resistance (Resistivity) at 27°C	19 x 1012 Ohm-cms.
4	Flash point P.M. (Closed)	1400C(Min)
5	Interfacial tension at 27°C	0.03 B+N+M or more
6	Neutralization value (total acidity)	0.5mg of KOH/g or less
7	Water content PPm	33 (Max)

4.5.4.4.5 PERCENTAGE IMPENDENCE:

The value of impedance of transformer at 75°C shall be 4.5% and tolerance shall be in accordance with IS: 1180(part I) 2014.

4.5.4.4.6 INSULATION LEVELS:

Sl No.	Voltage (kV)	Impulse Voltage (kV Peak)	Power Frequency Voltage (kV)
1	0.433	-	3
2	11	75	28

4.5.4.4.7 LOSSES AND IMPENDENCE:

The bidder shall guarantee individually the no-load losses and loss without any positive tolerance. The bidder shall also guarantee the total losses at 50% and 100% load condition (at rated voltage and frequency and at 75°C). The maximum allowable losses & impedance at rated voltage and rated frequency permitted at 75°C for 11/0.433kV transformers as follows:

Voltage Ratio	Ratings (kVA)	Max Losses at 50% loading (watts)	Max Losses at 100% loading (watts)	Impedance %(subject to tolerance as per IS:2026)
11kV/433-250V	100	520	1800	4.5

4.5.4.4.8 PENALTY FOR NON PERFORMANCE:

During testing at supplier's works, if it is found that the actual measured losses are more than the values quoted by the bidder, the purchaser shall reject the transformer and he shall also have the right to reject the complete lot. Purchaser shall reject the entire lot during the test at suppliers works, if the temperature rise exceeds the specified values. Purchaser shall reject any transformer during the test at suppliers works, if the impedance values differ from the guaranteed values including tolerance.

4.5.4.4.9 Conservator:

Conservators shall be provided on transformers of rating 63KVA, 100KVA, When a conservator is fitted, the oil gauge and the plain or dehydrating breathing device shall be fixed to the conservator which shall also be provided with a drain plug and a filling hole (1¼ nominal size thread) with cover. In addition, the cover of the main tank shall be provided with an air release plug to enable air trapped within to be released. Unless the conservator is so located as to eliminate the possibility of air being trapped within the main tank.

a) Prismatic oil level indicator shall be provided on the side which will be fully covered detachable flange with single neoprene gasket and tightened with M.S. bolts and nuts.

b) The inside diameter of the pipe connecting the conservator to the main tank shall be with in 20 to 50 mm and it should project in to the conservator in such a way that its end is approximately 20 mm above the bottom of the conservator so as to create a sump for collection of Impurities. The minimum oil level (corresponding to - 5° C) should be above sump level.

c) The pipe from conservator tank connecting to main tank shall be sloping so that the oil falling from the pipe shall not fall directly on the active parts and shall fall on the side walls only.

d) The conservator shall be provided (except for 25KVA) with the drain plug and filling hole with cover. In addition, the cover of the main tank shall be provided with an air release plug (except for 25KVA).

e) Conservator pipes fixing conservator to the top plate of the transformer should be on either side of metal pocket provided for mounting LT bushings with minimum electrical clearance of 110mm between phases and also earth.

BREATHERS :

Breather joints shall be of bolted type. It shall have die cast Aluminium body and inside container for Silica gel shall be of tin. Makes of Breathers shall be subject to BESCOM approval. The volume of the breather shall be

a) 250 grams of silica gel breather shall be provided for 25 KVA, 63 KVA and 100 KVA transformers.

The breather shall have an inspection window to view the condition Page 16 of 37 of the silica gel.

Breather joints shall be of bolted type. It shall have die cast Aluminium body and inside container for Silica gel shall be of tin. Makes of Breathers shall be subject to BESCOM approval. The volume of the breather shall be a) 250 grams of silica gel breather shall be provided for 25 KVA, 63 KVA and 100 KVA transformers. The breather shall have an inspection window to view the condition Page 16 of 37 of the silica gel.

4.5.4.4.10 **Internal Earthing:**

The framework and clamping arrangement of core and coil shall be securely earthed inside the tank by Copper strap connection to the tank.

4.5.4.4.11Terminations:

i. Transformers shall be fitted either with bushing insulators or with air insulated cable boxes / air insulated cable box with disconnecting chamber, as per requirement based on transformer HV incomer.
ii. The neutral of the star-connected winding shall be brought out to a separate bushing terminal. The neutral bushing shall be provided on the tank side to facilitate lead of the earth conductor down to the ground level. For transformers 1000 KVA and above, tank mounted insulators shall be provided for supporting the neutral earthing bar of specified section, along its run from the neutral bushing to ground-level.

4.5.4.4.12 Bushings:

iii. Bushings shall be designed and tested to comply with the applicable standards specified in the specifications.
i. Bushing rated for 400A and above shall have non-ferrous flanges and hardware.
ii. Fittings made of steel or malleable iron shall be galvanized.
iii. Bushings shall be supplied with terminal connector clamp suitable for connecting the bushing terminal to the specified conductor/ cable.

4.5.4.4.13 **Bushing Current Transformers:**

iv. Whenever applicable, bushing shall be supplied with current transformers.
v. Secondary leads, including tappings, shall be brought to a weatherproof terminal box near the bushing.
vi. Bushing C.T. nameplate shall be mounted on the tank adjacent to the terminal box.

4.5.4.4.14 Cable Boxes and Disconnecting Chamber:

i. The cable boxes, wherever required as per the prescribed criteria, shall be complete with cable joint fittings or sealing ends as required, tinned copper lugs to suit specified cable, compound and all other accessories including compression type glands, armour earth clamps and body earth terminal.
ii. For Cable type of terminations, disconnecting chamber shall be provided to enable the transformer to be removed without unsealing the cables or draining oil from the main tank. The disconnecting chamber shall be air insulated and complete with seal-off bushings, removable flexible connectors/ links and removable covers.
iii. Cable boxes shall be designed to accommodate all cable joint fittings or sealing ends as required, including stress/ cones or other approved means for grading voltage stress on the terminal insulation of cables operating at voltages of 22 kV and above.

iv. Phase to phase and phase to ground clearances within the chamber shall be such as to enable either the transformer or cable to be subjected separately to HV tests.

4.5.4.4.15 TERMINAL MARKING PLATE AND RATING PLATES:

The transformer shall be provided with a Anodized aluminium/stainless steel plate securely fixed on the outer body showing the relative physical position of the terminal and their markings. This shall be in accordance with IS: 1180(Part1):2014. The transformers shall be provided with rating plate furnishing the information as specified in 1180(Part1):2014.

The month and year of delivery shall be indicated on the rating plate. The rating plate shall be embossed / engraved type but not painted.

4.5.4.4.16 Maintenance Requirements For Transformers & Associated Equipment:

a) The construction of the transformer & location of the accessories like CTs, lower ends of bushings, terminals, tap-changers etc., shall be such as to afford easy access & permit replacement of auxiliaries without removing the tank cover.

b) Instruments & wiring in the local marshalling box (cabinet) shall be completely accessible & sufficient working space shall be made available in the cabinet. Instruments, wiring & accessories in the cabinet shall be accessible from the front & the rear as well.

c) The rating plate of the transformer shall be supplied as per latest version of IS: 2026.

d) Transformer shall be capable of being used with any make of transformer oil complying with IS: 335.

e) As far as practicable, transformer & accessories shall be so designed that no special tools are necessary for installation & maintenance. However, if special tools are required, the Contractor shall supply one complete set of such tools along-with transformer.

4.5.4.4.17Performance Tests:

a) In addition to the routine tests specified in the latest edition of IS: 2026, tests listed out shall be carried out on the transformer and these shall be included in the quoted prices.

b) The tests shall be carried out in the presence of the Purchaser/ Purchaser's representative. The following tests shall be carried out on the assembled transformer during inspection at the manufacturer's works
   i. Measurement of resistance of windings at principal and extreme taps.
   ii. Ratio at each tap, polarity and phase relationships

iii. Measurement of impedance voltage at principal and extreme taps
iv. Measurement of no load current and no load losses at rated frequency and at both the rated voltage and 110% rated voltage
v. Measurement of efficiency at ½, ¾ and full load
vi. Measurement of insulation resistance
vii. Induced over voltage withstand test
viii. Separate source voltage withstand test
ix. Magnetic balance test
x. Vacuum & Pressure Test for the tank.

c) In addition to the above tests, lightning impulse withstand test shall be carried out on one limb of HV winding of the transformer if impulse test has not been already carried out on transformer of similar or higher capacity in the last five years. Similarly heat run test shall also be carried out if the same has not been already carried out on transformer of similar or higher capacity in the last five years. Type test certificate shall be submitted along with the bid. if such a test has not been already carried out then same has to be carried out & witnessed by third party (such as CPRI) at the contractor's expense.

d) All tests required by the specification including repeated tests and inspection that may be necessary owing to the failure to meet any tests specified, shall be carried out at the Contractor's expense.

e) If the transformer fails to pass the tests specified, the Client shall have the option to reject the unit. Additional tests shall be conducted to locate the failure and after rectification, all tests shall be repeated to prove that the rebuilt transformer meets the specification in all respects, all at the Contractor's expense.

f) **Drawings/ Documents Required:**

Contractor shall submit the following drawings/ documents for Purchaser's approval:

a) General arrangement drawing of the transformer, showing plan, front elevation and side elevation complete with all accessories and fittings, detailed dimensions, net weights, quantity of oil, crane lift for untanking, size of lifting lugs and eyes, clearances between HV terminals, between LV terminals, between HV and LV terminals, between HV & LV terminals and ground etc

b) Rating, diagram and terminal marking plates, complete with polarity and vector group

c) Foundation drawing

d) General arrangement of HV cable box with air insulated disconnecting chamber.

e) General arrangement of LV Cable Box or Bus Duct arrangement.

f) General arrangement of marshalling box & wiring diagram.

g) General arrangement of OLTC/ RTCC & wiring diagram

h) GTP for Transformer

g) **Off Circuit Tap Changing Mechanism (OCTC) for Transformer < 1000 KVA:** OCTC shall be with + 5% to –10% taps in steps of 2.5 % on HV winding of transformer; It shall comprise:

a) Operating handle or wheel, accessible from ground level. Tap changer operating switch mounted on the top of the transformer tanks will not be acceptable

b) Tap position indicator.

c) Pad locking arrangement without interfering with visual tap position indicator shall be provided.

d) The tap-changer connections and contacts shall be accessible through an excess hole having a bolted gasketted cover.

4.5.4.5 **TRANSFORMER FITTINGS** :

100 KVA transformer shall be fitted with all standard and special fittings and accessories as per IS and BIP Standard and shall include but not to be limited to the following :

a) Rating, diagram and tap connection plates.

b) Terminal marking plate.

c) The earthing terminals.

d) Lifting lugs, jacking pads and haulage lugs / holes.

e) Under carriage with flanged bi-directional wheels with locking and bolting devices.

f) Cooling fans.

g) Limit switches.

4.5.4.6 **TECHNICAL PARTICULARS OF THE TRANSFORMER** :

Sl. NO	Item	11kv Distribution transformers
1	System voltages (max).	12kV
2	Rated voltages HV	11KV
3	Rated voltages (No Load)LV	433-250V
4	Rated Frequency	50Hz

5	Phases	Three
6	Connection HV	Delta
7	Connection LV	Star (Neutral brought out)
8	Vector group	Dyn-11
9	Rated KVA	100KVA
10	Method of system Earthing	Secondary solidly grounded
11	Type of cooling	ONAN as per IS 2026
12	% of impedance at 75 °C	4.5%
13	Fault level of the system	750MVA
14	Tap-Changer and tappings provided	Off-circuit Tap-changer (OCTC) on 11 KV side with -5% to +5% in steps of 2.5%.
15	11 KV side Terminal arrangements	11 V cable box suitable for termination of 1 no. 3-core. 240sq.mm. XIPE (AL) Armoured Cable.
16	0.433 KV side Terminal arrangements:	Low Voltage cable box Suitable For termination of 2 no. 3.5 core 185 sq.mm. PVC (AL) Armoured Cable.

415V LT Panel

- Applicable Standards: The design, manufacture and performance of equipment shall conform to the latest standards specified below. In case of conflict between standards and this specification, this specification shall govern.

  - Metal enclosed switchgear : IS: 3427 General requirements
  -Factory Built Assemblies of SWGR : IS: 8623 / BS: 5486 / IEC: and Control gear for Voltages up to and including 1000V AC & 1200VAC
  -Air Break Switches : IS: 13947-P3 / BSEN6049 / IEC: 947-3
  -Miniature Circuit Breakers : IS: 8828 / BSEN: 60898
  -Low Voltage Fuses : IS: 13703 / BS: 1362 / IEC: 269-1
  -Contactors : IS: 13947 / BSEN: 60947 4 / IEC: 947-1
  -Starters : IS: 13947 / BSEN60947-4/ IEC: 292-1 To 4
  -Control Switches & Push buttons : IS: 6857 / BSEN: 60947
  -Current Transformer : IS: 2705 / BS: 7626

-Voltage Transformer	: IS: 3156 / BS: 7625 / IEC: 44, 186
-Indicating instruments	: IS: 1248 / BS: 89 / IEC: 51
-Marking and Identification of -Conductors and Apparatus -Terminals	: IS: 11353 / BS: 159
-A.C. Electricity Meters	: IS: 722, 8530 / BS: 5685 / IEC 145,211
-Degree of Protection	: IS: 13947 / IEC: 947-P1
-Selection installation and maintenance of switchgear and control gear	: IS: 10118
-Code of practice for phosphating iron and steel	: IS: 6005 / BS: 3189
-Specification for copper rods and bars for electrical purposes	: IS: 613
-Control transformers for switchgear and control gear voltage not exceeding 1000V AC	: IS: 12021

- The L.T. Panel is required for providing power to motor feeder, heating system, power controller, etc. The panel should be for 415 V + 10%, 50 Hz + 5%, 3-phase, 4-wire. The incoming shall be provided from 100 KVA transformers.
- The panel shall be 14 S.W.G. CRCA sheet steel enclosed floor m mounting type, self-supporting, fully compartmentalized , dust & vermin proof, cubicle pattern, non-draw out and modular in construction. It shall be finish painted with powder coating paint after necessary chemical treatment for rust free surfaces and anti-rust chemical coating. The base frame of the panel shall be made of ISMC- 100 Channel.
- The panel shall be dead front type with concealed type khinged doors at front and bolted type covers at rear. All hinged doors shall be interlocked with the respective switch/ MCC such that the cannot be opened while the feeder on. It shall have rear access and the cable termination arrangement shall be provided at the rear of the respective feeder modules. The vertical dropper bar chamber shall be placed in between two vertically oriented leeder modules.
- The minimum clearance between bus bars and between bus bar to earth shall be as per I.S.
- All outgoing feeder terminals shall be stud type. Incoming MCCB termination shall be done with extended bus bar. The cable termination chamber shall be provided with cable supporting clamps. Control wiring of the panel shall be done with 1.1 KV grade PVC insulated 2.5 sq.mm flexible copper wire with tinned copper lugs and marking ferrules at each end. All hinged doors shall be earthed with flexible copper wire. The panel will have under voltage relay, digital integrated meter. A continuous earth bus

of size 15-6 mm and made of galvanized steel shall run through out the length of the panel with drilled holes at the ends for connecting the same with station earth bus.

- All panels shall be made up of CRCA sheet steel of following thickness -
  i. Load bearing members - 2.5 mm.
  ii. Doors and partitions - Doors – 2 mm, Partition - 1.5 mm.
  iii. Mounting plate - 2 mm.
  iv. Gland plate - 3 mm for both incomer and outgoing. For single core cable these plates shall be non magnetic.
- All the indoor switchgear panels shall be suitable for IP-54 degree of ingress protection for the enclosure. Outdoor panels shall be with minimum IP-55, degree of protection
- Each compartment & component shall be provided with name plates (with white letters on Black background) at front, inside & rear side.
- Equipment nameplates shall be fixed by screws/ rivets and shall not be pasted.
- Metallic Shrouding shall be provided for the isolation of main and vertical bus; as well as to avoid accidental contacts with live parts.
- Drawing pocket shall be provided on the inside of incomer feeder door.
- Provision for Top/ Bottom cable entry shall be made to suit the site condition.
- Lifting hooks/ eyes shall be provided in each shipping section of the equipment and shall be removable type.
- All the panels shall be provided with 20% extra power & control terminals.
- All unused contacts of the circuit breaker, protection, auxiliary, control relays shall be wired up to the terminal block.
- All terminals of different control voltages shall be separate from each other.
- Stud type terminals and ring type lugs shall be used for control cables.
- All the control/ power wiring shall be dressed neatly & the wire running through troughs shall be provided with covers
- **415V Incomer Feeders**

a) One no. 250A, Four Pole (FP), 415 Volt, 50 HZ AC operating voltage Moulded case Circuit Breaker (MCCB) with Microprocessor based O/L, S/C and E/F (in built) release shall be provided

b) 0-1500 Amps AC analog Ammeter, 96 sq.mm, class-1.5 CT Sec.- 5A

c) 0-600Volts AC analog Voltmeter 96 sq.mm. Class-1.5

d) Ammeter and Voltmeter selector switch

e) 50/5 to 400/5A bar primary type CT class-0.5, 5 VA (Tape wound)

f) Control Fuse/ MCB based on Fault level at the Bus;

g) Trivector Meter

h) R, Y, B indicating Lamps

i) CT, PT with required ratios & appropriate burden & class.

j) 250 Amps. TPN Aluminium Bus-bar

- **415V Outgoing Feeders**

  (i) One no. 200A 4P, 415V, 50Hz AC operating VOLTAGE MCCB with Microprocessor based O/L, S/C & E/F release along with ON, OFF & TRIP Indications.

  (ii) One no 5-32A MCB for Lighting distribution board.

  (iii) 1 nos. 5-32A MCB for spare feeder.

  (iv) 1 nos. 5-32A MCB feeder for Operating Aviation lamp with 12 Hrs timer and necessary controls.

4.5.5 HT, LT & CONTROL CABLES

- All the HV cables shall be Earthed grade (as per system requirement), multistranded Al conductor, XLPE insulated, inner/ outer extruded PVC sheath ST2, galvanized steel flat strip armoured cables.
- The LT cables shall be 1.1 kV grade, multi-stranded Copper/ Al conductor, PVC insulated, colour coded, inner and outer extruded PVC sheathed, galvanized steel round wire/ flat strip armoured cables.
- LV multi-core cables for use on 415 V and 240 V power supply system shall be PVC insulated multi-stranded aluminium conductors for sizes 6 sq mm and above and / PVC insulated Copper Conductors for sizes below 6 sq mm.
- Control cables will be PVC insulated multi-stranded copper conductor armoured cables.
- The construction, performance and testing of cables shall comply with IS 7098 -2011 Part II for HT XLPE armoured cables, IS 7098 -1988 Part I for LT PVC cables and IS1554 - 1988 -Part-I for PVC cables.
- Power and control cables will be laid buried underground as per good engineering practices. At small stretches the cables may be laid fastened on the wall/ ceiling with aluminium saddle –spacer.

- For lighting fixtures (Cremation hall, furnace hall, toilet etc. areas) & 5A socket 1100V grade, FRLS PVC, multi-stranded Copper conductor wires of size not less than 1.5 sq mm laid in min. 25 mm dia, 2mm thick PVC conduit shall be used.

Table 1: Cable Details

Sl. No.	Area	Cable details
1	Double pole structure to Transformer Primary	
2	Transformer secondary to 415V main distribution panel	2R x 185 sq. mm. x 3.5 core 1.1 K.V grade P.V.C insulated Al. armoured cable
3	Main Distribution panel to Furnace control panel	120 sq. mm. x 3.5 core 1.1 K.V grade P.V.C insulated Al. armoured cable
4	Main Distribution panel to Lighting distribution Board.	1R x 4 core, x 2.5 sq. mm. FRLS P.V.C insulated 1.1 K.V grade Copper wire.

Other cables:

1) 1.1 KV grade, 3 -core , 50 sq.mm. XLPE armoured aluminium cable from Furnace control panel to Primary and secondary chambers.

2) 1.1 KV grade, 3 -core , 35 sq.mm. XLPE armoured aluminium cable from Furnace control panel to ID fan.

3) 1.1 KV grade, 3 -core , 1.5 sq.mm. PVC Armoured copper cable from Furnace control panel to door motor.

4) 1.1 KV grade, 3 -core, 4 sq.mm. PVC Armoured copper cable from Furnace control panel to pump for scrubber.

5) 1.1 KV grade, 3 -core, 2.5 sq.mm. PVC Armoured copper cable from Furnace control panel to Fresh air fan Motor.

6) 1.1 KV grade, 2-core, 1.0 sq.mm. PVC Armoured copper cable from Furnace control panel to aviation lamp and door limit switch.

The cables shall be laid in ground / GI pipe / masonry trench etc. as per requirement and instruction of Engineer-In-Charge. The contractor shall have to supply and install necessary brick, GI pipe etc. as required for laying the cables as per II rule and working condition both in Sub-station and Electric Cremation Furnace in a descent manner. After completion of works, cables must be tested to at least double the normal working opressure according to provision of the Indian Electricity Act and Rules and shall be approved by Govt. Electrical Inspector etc. All responsibilities for the statutory high pressure tests to be conducted by the Power Supply

Authorities and the inspections of the Govt. Electrical Inspector before commissioning are to be borne by the contractor which are included in schedule of works and the contractor shall have to make all necessary arrangement for those tests and inspections.

4.5.6 EARTHING

- The safety earthing system will be generally designed on the basis of following codes and standards:

  a) IS 3043 - 2006: Code of practice for Safety Earthing

  b) IEEE 80 – 2013: IEEE Guide for Safety in Sub-station Earthing.

  c) Central Electricity Authority (CEA) Regulations – 2010

- Presently the fault currents considered are as tabulated below-

Table 2: Earthing Details

Sr. No.	System	Fault Level & duration
1	11 kV	26 kA for 1 Sec
2	415 V	Based on the rating of Transformer

- Following factors will be considered for sizing the earthing conductor.

  a) Design Ambient Temperature 50°C

  b) Allowable temperature rise 500°C

  c) For steel welded joints

  Fault clearing time 1.0 seconds.

- With reference to IS 3043 - 2006, overall earthing resistance shall be designed to achieve less than 1 Ohm. All the earthing stations will be interconnected by GI strip conductors below ground to form a grid to reduce the effective resistance.
- The soil resistivity measurement of the STP area shall be carried out by Contractor after finalization of contract however for the present consideration 100 ohm meter has been considered.
- Earth stations shall comprise of Copper plate earthing, GI Pipe earthing electrode and GI & Copper Earth strip for connecting grid. All the copper and GI earth electrodes

shall be as per IS 3043. The description of each type of electrode is as mentioned below;

a) GI Pipe Earthing**:**

40mm Dia. 3000 mm long Heavy duty, GI pipe electrode as per IS 3043. Charcoal & Salt shall be provided for earth pits. Installation as per IS 3043.

- Following equipment shall have dedicated GI Pipe eathing as mentioned below ;

a) Transformer Body – 2 nos. per transformer

b) Lightning protection – 1 nos. per downcomer

c) Panel - 2 nos.

4.5.7 LIGHTNING PROTECTION

- The lightning protection system need will be established by calculating the risk factor value of each building, structure etc. as per procedure given in IS/IEC 62305, Part-2 - 2010.
- For Building structure and any other tall structure, if found necessary, Air termination system comprising of horizontal roof conductors will be provided. Spacing between the roof conductors will be as recommended by IEC 62305 - 2010.

4.5.8 ILLUMINATION

- All the rooms, internal roads, outdoor areas etc will be illuminated by appropriate luminaries with suitable type and wattage lamps. Indoor lighting illumination levels will be as per IS 3646 and where as outdoor lighting illumination level will be as per IS 1944.

- Normal Lighting within electric crematorium shall be carried out as follows:

Table 3: Fixture details

Sl. No.	Area Description	Type of Fitting
1	Furnace Room	4” X 28W LED fITTING
2	Crematorium Hall	4” X 28W LED fITTING

3	Scrubber shed	4" X 28W LED fITTING
7	Periphery Lighting	4" X 28W LED fITTING

- As mentioned above LDB shall supply power to all the lighting inside and outside the crematorium like street light, gate light or building periphery lights. Adequate spare feeders will be included for future use.
- One set of Aviation caution light shall be provided in the top of the chimney with required cabling.

4.5.9 POINT WIRING

- Point wiring covers the wiring between a circuit of the lighting panel to switchboard and then from switchboard to lighting fixtures connected to that circuit of the lighting panel.
- For receptacle circuits point wiring shall cover wiring between circuit of the lighting panel to receptacles connected to that circuit of the lighting panel.

5 TECHNICAL SPECIFICATIONS

5.1 EARTHWORK

5.1.1 SCOPE OF WORK

The work covered by this section of the specifications consists of furnishing all plant, labor, equipment, appliances and materials and in performing all operations in connection with earthworks of all underground supplies and services and for all structural units, stock piling, of specifications and applicable drawings, and subject to terms and conditions of the contract. The scope of this section of specifications is also covered with detailed specifications as laid down herein.

5.1.2 GENERAL

5.1.2.1 The Contractor shall acquaint himself with the nature of the ground, existing structures, foundations and subsoil which might be encountered during excavation of earthworks. The Employer does not guarantee or warrant in any way that the material to be found in the excavation will be similar in nature to that of any samples which may have been exhibited or indicated in the report, drawings or in any other contract documents or to material obtained from boring or trail holes. The contractor shall be deemed to have made local and independent inquiries and shall take the whole risk of the nature of the ground subsoil or material to be excavated or penetrated and the Contractor shall not be entitled to receive any extra or additional payment nor to be relieved from any of his obligations by reasons of the nature of such ground subsoil or material.

5.1.2.2 All excavations, cutting, and fills shall be constructed to the lines, levels and gradients specified with any necessary allowance for consolidation, settlement and drainage so that at the end of the period of maintenance the ground shall be at the required lines, levels and gradients.

During the course of the Contract and during the period of maintenance any damage or defects in cuttings and fills, structures and other works, caused by slips, falls or basins or any other ground movement due to the Contractor's negligence shall be made good by the Contractor at this own cost.

5.1.3 SITE PREPARATION

5.1.3.1 The Contractor shall construct and maintain accurate bench marks so that the lines and levels can be easily checked by the Project Engineer. The Contractor shall Construct and maintain such ditches, in addition to those shown on the plans, as will adequately drain areas under construction.

5.1.3.2 The Contractor shall perform a joint survey with the Project Engineer's representative of the area where earthwork is required, plot the ground levels on the drawings and obtain approval from him before starting the earthwork.

5.1.3.3 The Contractor shall Construct and maintain such ditches, in addition to those shown on the plans, as will adequately drain areas under construction.

5.1.3.4 The Contractor shall perform a joint survey with the Project Engineer's representative of the area where earthwork is required, plot the ground levels on the drawings and obtain approval from him before starting the earthwork.

5.1.4 EXCAVATIONS

5.1.4.1 Excavation shall include the removal of all material of every name and nature. Excavations shall be carried out in accordance with excavation plans and sections shown on the Drawings and as directed by the Project Engineer.

5.1.4.2 The major portion of excavations shall be carried out by mechanical excavators and excavated materials disposed off to stock on spoil as per drawings or as directed by the Project Engineer. The excavation which cannot be done by mechanical means including leveling, trimming and finishing to the required levels and dimensions shall be done manually. The material suitable for fill and back fill shall be stock piled within the free haulage limit of the 200m of the works.

5.1.4.3 The Contractor shall give reasonable notice that he intends to commence any excavation and he shall submit to the Project Engineer full details of his proposals. The Project Engineer may require modifications to be made if he considers the Contractor's proposals to be unsatisfactory and the Contractor shall give effect to such modifications but shall not be relieved of his responsibility with respect to such work.

5.1.4.4 For major excavations, the Contractor shall submit for the prior approval of the Project Engineer full details and drawings showing the proposed method of supporting and strutting etc. The design, provisions construction, maintenance, and removal of such works shall be the responsibility of the Contractor and all cost in these respects shall be included in the unit rates for the permanent work.

5.1.4.5 The Contractor's attention is drawn particularly to his obligations under the general conditions in respect of those works which are in close proximity to existing buildings.

5.1.4.6 The Contractor shall preserve the complete excavation from damage from slips and earth movements, ingress of water from any source what so ever and deterioration by exposure to the sun and the effects of the weather.

5.1.4.7 All excavation of every description, in whatever material encountered shall be performed to the elevations and dimensions shown on the drawings in such a manner as to avoid interruption to work in other parts of the site. The Contractor shall be responsible for injury to the permanent works caused by excavation on other parts of the works.

5.1.4.8 Excavation shall extend to sufficient distance from walls and footing to allow for placing and removal of forms, installations of services and for inspection, except where the concrete for walls and footings is authorized to be deposited directly against excavated surfaces.

5.1.4.9 All excavations in foundations shall be taken to 150mm and shall be trimmed carefully to a smooth and level surface, immediately after trimming to the final elevation a layer of building concrete shall be placed to the thickness shown on the drawings. All excavations for foundations which have been trimmed and disturbed shall be compacted and covered by concrete by the end of the day. It is specifically brought to the notice of the Contractor that any excavation taken down to the trimmed elevation which is left overnight or for any length of time thereafter, uncovered by the blinding concrete, shall be required to be trimmed to such lower elevation as directed by the Project Engineer and any extra work or any consequent increase in the quantities caused thereby shall not be paid to the Contractor.

5.1.4.10 No excavation shall be refilled nor any permanent work commenced until the foundation has been inspected by the Project Engineer and his permission to proceed given. If excavation for sub-structures are carried below the required level, as shown in the drawings or as directed by the Project Engineer, the surplus depth shall be filled in with concrete of same grade as of blinding concrete at the sole cost of the Contractor.

5.1.4.11 All excavation shall be performed in the dry. The placing of blinding concrete, placing of reinforcement and casting of the permanent works in the excavation shall be carried out in the dry and the Contractor shall have sufficient equipment for this purpose. Adequate precautions shall be taken to prevent any corrosion due to undercutting from underneath the previously constructed adjoining foundations.

5.1.4.12 Existing utility lines to be retained, as well as utility lines constructed during excavation and backfilling, and if damaged, shall be required to be repaired by the Contractor at his expense. Any existing utility lines which are not known to the Contractor in sufficient time to avoid damage, if inadvertently damaged during excavation, shall be repaired by the Contractor and adjustment in payment will be made as approved by the Project Engineer. When utility lines which are to be removed, are encountered within the area of operations the Contractor shall notify the Project Engineer in ample time for necessary measures to be taken to prevent interruption of the service.

5.1.4.13 Excavated material suitable for use as filling material shall be stock piled within the free haulage limit 200m of works as directed by the Project Engineer. This stock piled material shall be transported back to places requiring fill or backfill. Surplus or material unsuitable for use as filling shall be disposed of by the Contractor at locations approved by the Project Engineer within specified free haulage limit.

5.1.4.14 The Contractor shall make independent enquiries and perform and make independent observations to ascertain the water table in the areas of excavations during the period when the construction works are in progress. The Contractor shall take whole risk of any nature for fluctuation of the water table from his own findings. The Employer is not bound in any way and shall not be responsible for any information given by him or any information, observations or values obtained from his reports, drawings and documents.

5.1.4.15 Excavation for earth pits, cable trenches shall be taken out to the levels and dimensions as the Project Engineer may direct.

5.1.4.16 Before starting the excavations, the Contractor shall ensure the correct alignment of the trenches and location on the ground, the depth and width of excavation of the trench, all in accordance with the drawings and instructions of the Project Engineer.

5.1.4.17 The Contractor at his cost shall provide to the satisfaction of the Project Engineer all timbering, approved supports and shores and bracings to the sides of the excavated trench and foundations in such a manner to secure the sides of the trench and excavations from falling or adverse movement. All responsibility connected with such shoring shall rest with the Contractor. Adequate clearance / working space on both sides of the structure/pipe line shall be provided for which no payment shall be made.

5.1.4.18 Without the written permission of the Project Engineer no more than 50.0m the trench shall be opened in advance of the completed pipe line. The bottom of all excavations shall be carefully leveled. Any pockets of soft or loose material in the bottom of the pits and trenches shall be removed and the cavities so formed filled with lean concrete at the Contractor's expense.

5.1.4.19 The Project Engineer may require the Contractor to excavate below the elevations shown on the drawings or he may order him to step above the elevations shown depending upon the suitable foundation material encountered.

5.1.4.20 If for any reasons, the levels grades or profiles of the excavations are changed adversely, the Contractor shall at his own cost be liable to bring the excavations to the required levels and profiles as shown on the drawings or as directed by the Project Engineer.

5.1.5 EXCAVATION TOLERANCES

Excavation shall be performed within the tolerances for excavation limits indicated on the drawings. Where no tolerance limits are indicated excavation shall be performed to tolerances established by the Project Engineer as accepted for the design and type of work involved.

5.1.6 MEASUREMENT

Except otherwise specified herein or elsewhere in the Contract documents, no measurement and payment will be made for the under mentioned specified works related to the relevant items of the bill of quantities. The cost thereof shall be deemed to have been included in the quoted unit rate of the respective items of the bill of quantities.

Quantities of excavation shall be calculated / measured from the pre-work levels of natural ground taken jointly by the Contractor and the Project Engineer before Commencement of the work. The quantities set out for excavation and its subsequent disposal shall be deemed to be the bulk before excavating and no allowance shall be made for any subsequent variations in bulk or for any extra excavation unless otherwise shown on the drawings quantities of excavation shall be measured on the basis of vertical excavations required for

the nominal concrete dimensions of the structural members of foundations. Lean concrete shall not be construed as structural concrete.

Quantities of excavation for service line trenches shall be measured for payment on the basis of vertical excavation faces for the specified width as shown on the drawings. Measurement for acceptably completed excavation works shall be made on the basis of number of cubic meter of material excavated for foundation and service trenches as shown on the drawings or as directed by the Consultant's Project Engineer.

5.1.7 PAYMENT

Payment will be made for acceptable measured quantity of excavation on the basis of unit rate per cum, quoted in the bill of quantities and shall constitute full compensation for all the works related to the item.

5.2 BACK FILLING

5.2.1 After completion of foundation footing, foundation, walls, and other construction below the elevation of the final grades and prior to backfilling, forms shall be removed and the excavation shall be cleaned of trash and debris.

5.2.2 The backfilling shall include filling around the foundations, trenches.

5.2.3 Filling shall be approved selected material from excavation or other predominantly granular material and free from slurry, mud, organic or other unsuitable matter and capable for compaction by ordinary means.

5.2.4 The excavated material if found suitable shall be stock piled within the free haulage limit of the site of the works. This material shall be used for backfilling if approved by the project engineer and shall be transported by the contractor any where required for the purpose of backfilling work in this contract.

5.2.5 The contractor shall provide the approved quality fill and backfilling material as required to complete the fill/backfilling work. Filling in trenches and foundation shall be placed in 200 mm layers and compacted at optimum moisture content by mechanical means or other means as approved by the project engineer.

5.2.6 Fill in around trenches and pits shall be carefully placed with fine material to cover the completely before the normal infilling is done.

5.2.7 Material for back filling shall be as approved by the project engineer and shall be placed in layers of 150 mm measured as compacted material and saturated with sufficient water and compacted to produce in-situ density not less than 95% of the maximum density at optimum moisture content, achieved in test no.15 of IS 1377:1975 or similar clause of relevant is code.

5.2.8 All filled areas shall be left neat, smooth and well compacted with the top surface consisting of the normal site surface soil unless otherwise directed.

5.2.9 Depending on the depth of fill the project engineer may instruct increased thickness of successive layer to be placed.

5.2.10 Fill shall not be placed against foundation walls prior to approval by the project engineer. Fill shall be brought up evenly on each side of the walls as far as practicable. Heavy equipment for spreading and compacting the fill shall not be operated closer to the wall than a distance equal to the height of the fill above the top of footing.

5.2.11 Depending on the depth of fill the project engineer may instruct increased thickness of successive layer to be placed.

5.2.12 Fill shall not be placed against foundation walls prior to approval by the project engineer. Fill shall be brought up evenly on each side of the walls as far as practicable. Heavy equipment for spreading and compacting the fill shall not be operated closer to the wall than a distance equal to the height of the fill above the top of footing.

5.2.13 In case the contractor is instructed to arrange for the fill material the quality of the fill material will be subject to the approval of the project engineer. The project engineer shall require the contractor to carry out various tests of the fill material. All such tests shall be made at an approved laboratory at the cost of the contractor. Once a material from a specific source has been approved, the material for the same quality and from that source only shall be used. Any fill material from borrow pits which has not been approved or the quality of which differs from the approved material shall be rejected out rightly. The project engineer reserves the right to order removal of any such materials brought to the site of works at his discretion at contractor's expense. In order to ensure satisfactory compaction, it will be necessary to carry out, depending upon the type of material, particle size distribution tests, determination of organic content tests, maximum and minimum density tests and determination of optimum moisture content for the filling material.

5.2.14 The method of compaction, namely type of compactor, type of roller, weight of roller and number of passes proposed by the contractor for any particular fill material shall be subject to the approval of the project engineer after completion of satisfactory field tests, subsequent to the laboratory analyses, using the materials and equipment proposed to be used for the earth work in conditions similar to those likely to be encountered during construction.

The final selection of the soil moisture content, the thickness of layers, the type of compaction equipment and the number of passes shall be decided after these tests, which shall be conducted at contractor's expense.

5.2.15 Having established the method of compaction to be used, no departure from this approved method shall be permitted without the prior approval of the project engineer. Adequate control of the fill and compacting operations shall be ensured by in-situ density tests and in order to obtain significant results, not less than two measurements shall be carried out per one hundred square meters of area compacted. The frequency of tests shall be determined on site and may be varied at the discretion of the project engineer. Compaction shall not be less than 95% in-situ density with respect to the maximum density, at optimum moisture content.

5.2.16 The exact thickness of layers and the method of placing and compacting the fill shall be determined by the field tests, as stated above, but not withstanding the results of these trails, fill shall not be placed in layers exceeding 200mm in thickness. In order to maintain control of the thickness of layers, timber profiles shall be used wherever feasible. The travelers of such profiles for each layer of fill shall be checked by the supervisory staff of the project engineer. The contractor shall provide adequate supply of water and sufficient capacity of mechanical water carriers to ensure uniform and uninterrupted operation of compaction. The project engineer may forbid the contractor to proceed with placing and/or compaction of fill and/or order removal and re-compaction of such fill when he finds that the contractor has insufficient or defective equipment or that the fill has been improperly laid and/or compacted.

5.2.17 If it is found necessary to alter the moisture content of the fill material in any way, then very strict control shall be exercised over the wetting and/or the drying process and frequent moisture content tests.

5.2.18 The fill material should be well graded non-cohesive and nearly silt-free (silt content between 5 to 10 percent) salt free and free of organic materials (less than 2%). It should also be free of stones larger than 100 mm. Maximum dimension. It should be of such nature and characteristics that it can be compacted to the specified densities in reasonable length of time. It shall be free of plastic clays, of all materials subject to decay, decomposition or dissolution and or cinder or other material which corrode piping and other metals.

5.2.19 TOLERANCES

The stabilization of compacted backfill/fill surfaces shall be smooth and even and shall not vary more than 100mm in 3 meters from true profile and shall not be more than 12.5mm from true elevation.

5.2.20 DISPOSAL OF SURPLUS MATERIAL

5.2.20.1 The rejected unsuitable material and surplus excavated material shall be disposed of within 200 m free haulage limit measured from boundary of the works to places or as directed by the Project Engineer.

5.2.20.2 The disposal of surplus excavated material shall include loading, unloading, transporting, stacking, spreading as directed by the Project Engineer.

5.2.21 MEASUREMENT

Measurement for acceptable completed backfill/ fill works shall be made on the basis of number of cubic meter of compacted backfill/ fill in position, or as shown on the drawings or as directed by the Project Engineer.

5.2.22 PAYMENT

Payment will be made for acceptable measured quantity of backfill/ fill on the basis of unit rate per cu.meter quoted in the bill of quantities and shall constitute full compensation for all the works related to the item.

5.3 PLAIN AND REINFORCED CEMENT CONCRETE

The work covered by this section of the Specifications consists of furnishing all plant, labor, equipment, appliances and materials, and in performing all operations in connection with the supply and installation of plain and reinforced concrete work, complete in strict accordance with this section of the Specifications and relevant documents, subject to the Conditions of the Contract.

5.3.1 GENERAL

5.3.1.1 Full co-operation shall be given to other trades to install embedded items and/or any associated services.

5.3.1.2 Embedded items shall have been inspected, and tests for concrete and other material or for mechanical operations shall have been completed and approved, before concrete is placed.

5.3.1.3 Formwork shop drawings shall be designed and prepared by the Contractor at his own cost. Approval of shop drawings as well as those of mock-ups /actual samples of finished concrete shall be obtained before Work is commenced.

5.3.1.4 Contractor shall prepare bar bending schedules, and get the same approved by the Project Engineer, prior to commencement of work.

5.3.2 RELATED SPECIFICATIONS

The codes and standards generally applicable to the work of this section are listed herein after.

IS 269	:	Ordinary and low heat Portland Cement
IS 8041	:	Rapid Hardening Portland Cement
IS 455	:	Portland slag cement
IS 1489	:	Portland Pozzolana Cement
IS 8112	:	High Strength Ordinary Portland Cement
IS 383	:	Coarse and fine aggregates from natural sources for concrete
IS 456	:	Code of practice for plain and reinforced concrete
IS 516	:	Method of sampling and analysis of concrete
IS 1199	:	Method of sampling and analysis of concrete
IS 1139	:	Hot rolled deformed bars
IS 23896	:	Methods of testing of aggregates for concrete (Part I to III)
IS 2751	:	Recommended Practice for welding for reinforcement bars
IS 9103	:	Admixtures for concrete
IS 10262	:	Recommended guide lines for concrete mixed design

5.3.3 MATERIALS

5.3.3.1 CEMENT

a. Cement shall conform to standards listed in section 2 of IS:456, latest edition.

b. Only one brand of each type of cement shall be used for concrete in any individual member of the structure. Cement shall be used in the sequence of receipt of shipment, unless otherwise directed.
c. There shall be sufficient cement at site to ensure that each section of Work is completed without interruption.
d. Cement reclaimed from cleaning of bags or from leaky containers shall not be used.
e. Contractor shall provide and erect, at his own cost, in a suitable place, dry, well ventilated, and water proof shed of sufficient capacity to store the cement.
f. The cement shall be used as soon as possible after delivery, and cement which the Project Engineer considers has become stale or unsuitable through absorption of moisture from the atmosphere or otherwise shall be rejected and removed immediately from the site at Contractor's expense.
g. The mixing together of different types of cement shall not be permitted.

5.3.3.2 AGGREGATES

a. The sources of supply of all fine and coarse aggregates shall be subject to the approval of Project Engineer.
b. All fine and coarse aggregates shall be clean and free from clay, loam, silt, and other deleterious matter. If required, Project Engineer reserves the right to have them washed by the Contractor at no additional expenses. Coarse and fine aggregates shall be delivered and stored separately at Site. Aggregates shall not be stored on muddy ground or where they are likely to become dirty or contaminated.
c. Fine aggregate shall be hard coarse sand, crushed stone or gravel screenings and shall conform to requirements of IS: 383 latest edition.
d. Coarse aggregate shall be gravel or broken stone or hard, durable material free from laminated structure and conforming to IS: 383 latest edition. The aggregates shall be graded as follows for use in mass concrete as in foundations:

TOTAL PASSING	PERCENT BY WEIGHT
2" B.S. Sieve (50.00 mm)	100
1-1/2" Sieve (38.10 mm)	95-100
3/4" Sieve (19.00 mm)	35- 70
3/8" Sieve (9.50 mm)	10- 30
No. 4 Sieve (4.75 mm)	0- 5

Coarse aggregate for all cast-in-place concrete other than mass concrete as for foundations shall be graded with the following limits:-

TOTAL PASSING	PERCENT BY WEIGHT
1" Sieve (25.00 mm)	100
3/4" Sieve (19.00 mm)	90-100
3/8" Sieve (9.50 mm)	20- 55
No. 4 Sieve (4.75 mm)	0- 10

5.3.3.3 Water:

Only clean potable water from the city supply, tube well installed at the Site or from other sources approved by Project Engineer shall be used. Contractor shall supply sufficient water for all purposes, including mixing the concrete, curing and cleaning plant and tools. Where doubts exist as to the suitability of the water, it shall be tested in accordance with IS: 3025. Where water can be shown to contain any sugar or an excess of acid, alkali or salt, Project Engineer may refuse to permit use. As a guide, the following concentrations represent the maximum permissible values:

a. To neutralize 200 ml sample it should not require more than 2 ml of 0.1 normal NaOH.
b. To neutralize 200 ml sample it should not require more than 10 ml of 0.1 normal HCL.
c. Percentage of solids should not exceed the following:

	PERCENT
Organic	0.02
Inorganic	0.30
Sulphates	0.05
Alkali Chlorides	0.10

In case of doubt, Project Engineer may require that concrete mixed with water proposed to be used should not have a compressive strength lower than 90 percent of the strength of concrete mixed with distilled water.

5.3.3.4 Reinforcement

a. Reinforcement for concrete shall conform to the respective IS or other standards as specified in the drawings and Contract Documents or as may be specified by Project Engineer.
b. Unless otherwise specified, all plain reinforcing bars shall comply with the requirements of IS: 432, and shall have a minimum yield stress of 248 N/sq mm.
c. Unless otherwise specified, all deformed reinforcing bars shall comply with the requirements of IS: 1786 for deformed cold worked steel bars and shall have minimum characteristic stress of 415 N/sq mm.

d. Reinforcement shall be obtained only from manufacturer's approved by Project Engineer. If and when required Contractor shall provide all necessary facilities to Project Engineer for the selection of test pieces and shall cause these to be prepared and submitted where directed for tests at Contractor's cost.
e. If the reinforcement is to be supplied by Employer, Contractor shall inform Project Engineer of his requirements much before its use in construction.
f. Reinforcement of all types is to be stored at Site in an approved manner so as to avoid damage.
g. Contractor shall report immediately on receipt of any consignment, having any deviation in the standard weights of the reinforcing bars beyond those allowed in respective standards mentioned in clause (3.3.3.4.b) and (3.3.4.4.c) herein before.

5.4 CONCRETE MIX PROPORTIONS

5.4.1 GENERAL:

The proportions of ingredients shall be such as to produce a mixture which will work readily into the corners and angles of the forms and around reinforcement by the methods of placing and consolidation employed on the Work, but without permitting the materials to segregate or excessive free water to collect on the surface. Specific approval of the Project Engineer is required to waive limitations on mixture proportions.

The proportions of ingredients shall be selected in accordance with Section 5.7 to produce the proper placebility, durability, strength and other required properties.

5.4.2 STRENGTH

The Specified compressive strength of the concrete cube, shall be 15 N/sq mm. or 20 N/sq mm.. Samples from fresh concrete shall be taken as per IS: 1199 and cubes shall be made, cured and tested at 28 days in accordance with IS: 516.

5.4.3 DURABILITY

Requirements of Clause 7 of IS: 456-1978 shall be followed.

5.4.4 SLUMP

Unless otherwise permitted or specified, the concrete shall be proportioned and produced to have a slump of 100 mm or less. A tolerance of up to 25 mm above the indicated maximum shall be allowed for individual batches provided the average for all batches or the most recent 10 batches tested, whichever is fewer, does not exceed the maximum limit.

Concrete of lower than usual slump may be used provided it is properly placed and consolidated.

Note: If S.R. Cement is used, permissible water-cement ratio may be increased by 0.05.

Slump shall be determined by the "Test for slump for Portland Cement Concrete" as per relevant IS code.

5.4.5 MAXIMUM SIZE OF COARSE AGGREGATE:

The nominal maximum size of the aggregate shall be 20.mm for all portions of the structure except footings which may be 38 mm. These limitations may be waived if, in the judgment of the Project Engineer, workability and methods of consolidation are such that the concrete can be placed without honeycomb or voids.

5.4.6 ADMIXTURES:

If required or permitted, admixtures used shall be in accordance with the manufacturer's instructions except as otherwise specified herein.

5.4.7 METHODS OF OBTAINING MIX DESIGN:

For concrete of normal weight, mix proportions to provide the desired characteristics shall be developed using the methods/procedure covered by the Recommended Practice for Selecting Proportions for Normal Weight Concrete ACI-211.1-77/ IS:456- 1978.

Trial mixtures having proportions and consistencies suitable for the Work shall be made based on above codes, using at least three different water-cement ratios which will produce a range of strengths encompassing those required for the Work. Trial mixes shall be designed to produce the specified slump. The temperature of concrete used in trial batches shall be reported.

For each water-cement ratio, compression test of cube shall be made, cured, and tested in accordance with IS:1199 and IS:516. From the results of these tests a curve shall be plotted showing the relationship between the water-cement ratio and compressive strength. From this curve, the water-cement ratio to be used in the concrete shall be selected to produce the required design strength. The cement content and mixture proportions to be used shall be such that this water- cement ratio is not exceeded when slump is the maximum permitted. Control in the field shall be based upon maintenance of proper cement content and slump.

5.5 Ready mix concrete

5.5.1 GRADES AND STRENGTH REQUIREMENTS OF CONCRETE

General

Ready mix Concrete shall consist of the material described under site batched concrete sections, using separate coarse and fine aggregate in an appropriate combination determined in the course of the of mix design . The overall grading shall be such as to produce a concrete of the specified quality which will work readily in to position without segregation. The ready

mix concrete shall conform to IS: 4926 and shall be delivered in agitating trucks. The RMC may contain flyash as per the acceptable norms.

Slump

The water shall be added to the cement and aggregate during mixing to produce concrete having a sufficient workability to enable it to be well consolidated, to be worked in to the corners of the shuttering and around the reinforcement to give the specified surface finish, and to have the specified strength. Water cement ratio shall be maintained as per IS456-1978 when a suitable amount of water has been determined, the resulting consistency shall be maintained throughout the corresponding parts of the work and tests shall be conducted to ensure the maintenance of this consistency. The max slump at the point of the discharge should not exceed 110mm max.

Concrete Grades

Grade of concrete used in the works shall be shown on the drawings or as directed by the Architect/Project Manager. The minimum cement used for M-20 shall be 300 Kg. Per Cum, 350 Kgs for M-25 and 400Kgs for M-30.

5.5.2 TRANSPORTING CONCRETE

Concrete shall be transported in agitating trucks without contamination, loss of ingredients or segregation. In no case shall a period of more than 4 hours have elapse between the wetting of mix and discharge of the concrete at site.

5.5.3 CONCRETE PLACEMENT

5.5.3.1 Concrete, when deposited, shall have a temperature of not less than $5^{o}C$ ($41^{o}F$) and not more than $32^{o}C$($90^{o}F$).

5.5.3.2 The concrete shall be placed in the positions and sequences indicated on the drawings, in this specification and/or as directed by the Architect/Project Manager.

5.5.3.3 Contractor shall give adequate notice to the Architect/Project Manager of his intention to concrete any section of the works.

5.5.3.4 Except where otherwise directed, concrete shall not be placed unless the representative of the Architect/Project Manager is present and has previously examined and approved the positioning, fixing and condition of the reinforcement or any other items to be embedded and the cleanliness, positioning and suitability of the concreting surface.

5.5.3.5 The concrete shall be deposited as nearly as possible in its final position. It shall be placed in such a manner as to avoid segregation of the concrete and displacement of the reinforcement, other embedded items, or formwork. It shall be brought up in horizontal layers not exceeding 450 mm in compacted thickness unless otherwise authorized or directed by Architect/Project Manager. Concrete shall not be placed simultaneously on each side of large horizontal specified or approved construction joints.

5.5.3.6 Shutters for walls or thin sections of considerable height shall be provided with openings or other devices that will facilitate the cleaning of the accumulation of hardened concrete on the shutters or on the metal reinforcement above the level of theconcrete and the removal of concrete in the case of segregations.

5.5.4 QUALITY CONTROL

5.5.4.1 In order to ensure that the quality of materials and the mix proportions are suitable for the particular grade of concrete required are so maintained, sampling and testing shall be carried out regularly during the course or the works.

5.5.4.2 Workability testing shall be carried out in accordance with IS:456. The results shall lie within the range upon which the accepted mix design is based. Testing shall be carried out at such a frequency that the required workability is consistently achieved.

5.5.4.3 Samples of concrete shall be taken at random in accordance with IS: 516 at the time and place of deposition of the concrete at a frequency of sampling for each grade of concrete and from each concrete mixing plant at six cubes of 150 mm nominal size per 50 cubic meters of concrete placed in the works or twice per week.

5.5.4.4 Notwithstanding the foregoing, additional samples shall be taken by the contractor when directed by the Architect/Project Manager. The test cube procedure shall be in accordance with IS: 516 throughout.

5.5.4.5 Compliance with the specified characteristic strength shall be assumed if:

a. Each of the six cubes in a group has a test strength not less than the characteristic strength or,
b. Not more than one cube has a test strength less than the specified characteristic strength but not less than 85% of the specified characteristic strength and the average strength of the group of four test results is not less than the specified characteristic strength plus the standard deviation of the group.

5.5.5 SEVEN DAY CUBE TESTS

Acceptance of concrete is based on the 28th day results. However, the contractor shall establish a relationship between 7 days and 28 days strengths by carrying out 7 days tests at the time of performing the laboratory testing and from subsequent quality control testing. This relationship shall be used in interpreting any further test results to predict the probable value of the corresponding 28 days cube strengths. The contractor shall without delay advise the Architect/Project Manager of any sample that appears likely to fail to meet the specification and the contractor shall take any necessary action to minimize the effect of such failure.

5.5.6 ACCEPTANCE CRITERIA

The general Acceptance Criteria of any and all of the concrete work shall be as per the relevant Clauses of IS. 456. If any of the works tests are not up to the standard, the Architect/Project Manager shall have the power to stop the work until the reason is investigated and steps taken to prevent further low results. The contractor shall not be entitled to any claims on account of such delays. Any concrete carried out from the batch that is afterwards found to be faulty, will be liable for rejection and if so directed, the contractor shall at his own expenses dismantle and replace the defective work and any work built thereon or shall take such other measures as may be deemed necessary by the Architect/Project Manager. At the discretion of the Architect/Project Manager, the contractor may be allowed to prove by means of a load test to be carried out at his own expense, that the concrete is capable of safely withstanding the loads as specified in the test.

5.5.7 QUALITY OF WATER

- Water used for both mixing and curing shall conform to IS: 456. Potable water is generally satisfactory. Water containing any excess of acid, alkali, sugar or salt shall not be used.
- The pH value of water shall not be less than 6.
- Seawater shall not be used for concrete mixing and curing.
- The proposed admixtures shall comply with requirements of specification part 11- Water sealing materials.

5.6 STEEL REINFORCEMENT

5.6.1 SCOPE OF WORK

The work to be done under this section consists of furnishing, cutting, fabricating, bending, placing and tying steel reinforcement in concrete structures or elsewhere asshown on the drawings or directed by the Project Engineer. The scope of this section of this section of specifications as laid down herein.

5.6.2 MATERIAL AND SIZE OF BARS

5.6.2.1 Reinforcement for concrete shall conform to the respective Indian or other standards as specified in the drawings and in the contract documents or as may be specified by the Project Engineer.

5.6.2.2 Unless otherwise specified, all plain mild steel reinforcing bars shall comply with the requirements of IS: 432 (Part- I) and shall have a minimum yield stress of 250 N/mm.sq.

5.6.2.3 Unless otherwise specified, all deformed reinforcing bars shall comply with the reinforcements of IS: 1786 for deformed cold twisted steel bars and shall have a minimum characteristic strength of 415 N/mm.

5.6.2.4 Reinforcement shall be obtained only from manufacturers approved by the Consultant/Project Engineer. Each consignment of reinforcement steel shall be accompanied by a manufacturer's certificate or shall refer to a previous certificate, if the consignment is from the same batch, showing that the reinforcement steel complies with the following requirement

5.6.2.5 If such certificate is not made available or if the Consultant / Project Engineer considers that the manufacturer's tests are inadequate, samples shall be taken for acceptance test from different consignments as the Project Engineer may direct and shall be tested at the Contractor's cost should the result of such that any sample does not meet with the specifications, the whole consignment shall be rejected and removed from the site at the Contractor's cost.

5.6.2.6 Reinforcement of all types is to be stored on site in approved manner so as to avoid damage.

5.6.2.7 Reinforcement shall be free from all loose or flaky rust and mill scale or coating, including ice, and other substance that would reduce or destroy the bond. Reduced section steel reinforcement shall not be used.

5.6.2.8 If such certificate is not made available or if the Consultant / Project Engineer considers that the manufacturer's tests are inadequate, samples shall be taken for acceptance test from different consignments as the Project Engineer may direct and shall be tested at the Contractor's cost should the result of such that any sample does not meet with the specifications, the whole consignment shall be rejected and removed from the site at the Contractor's cost.

5.6.2.9 If such certificate is not made available or if the Consultant / Project Engineer considers that the manufacturer's tests are inadequate, samples shall be taken for acceptance test from different consignments as the Project Engineer may direct and shall be tested at the Contractor's cost should the result of such that any sample does not meet with the specifications, the whole consignment shall be rejected and removed from the site at the Contractor's cost.

5.6.2.10 Reinforcement of all types is to be stored on site in approved manner so as to avoid damage.

5.6.2.11 Reinforcement shall be free from all loose or flaky rust and mill scale or coating, including ice, and other substance that would reduce or destroy the bond. Reduced section steel reinforcement shall not be used.

5.6.2.12 Steel wire mesh reinforcement shall conform to requirement of relevant Indian codes or those of ASTM: A 185-64 or BS. 4483, 1969: Standard Specifications for welded steel wire fabric for concrete reinforcement. It shall be used where shown on the drawings.

5.6.2.13 Applicable standards

Latest editions of Indian Standards as per 4.3 or other International Standards

5.6.2.14 DELIVERY & STORAGE

Delivery

Steel reinforcement bars shall be delivered in bundles firmly secured and tagged. Each bars or bundle of bars shall be identified by marks stamped on hot or cold or painted on or by any other means. The identifying marks shall contain the following information:

a. Name of the producer or his trade.
b. Standard to which the bars have been manufactured.
c. The clause, type and strength respectively.
d. The diameter.
e. The number of the test certificate (if available).

Storage

The method of storage shall be approved by the Project Engineer. Reinforcing bars shall be stored in racks or platforms above the surface of ground and shall be protected free from scaling, rusting, oiling, coatings, damage, contamination and structural defects prior to placement in works. Bars of different diameters and grades of steel reinforcement shall be kept separate.

5.6.2.15 BAR BENDING SCHEDULES

The Contractor shall prepare bar bending schedule of all the reinforcing steel bars and these bar bending schedules will be supplied to the Consultants/Project Engineer in duplicate on the basis of which the work shall be carried out. However, the Contractor shall be responsible to satisfy himself as to the correctness and accuracy of the bar bending schedule. Any discrepancy shall immediately be notified to the Consultant / Project Engineer before commencing work.

5.6.2.16 MEASUREMENT & PAYMENT

Except otherwise specified herein or elsewhere in the Contract documents, no measurement and payment will be made for the under mentioned specified works related to the relevant items of the Bill of Quantities. The cost thereof shall be deemed to have been included in the quoted unit rate of the respective items of the Bill of Quantities. Providing and installing chairs, supports, hooks, spacers, binding wires, and laps not shown on drawings including wastage and rolling margin.

Measurement

Measurement for acceptably completed works of reinforcement shall be made by weight according to bar bending schedules approved by the Consultant / Project Engineer.

Payment

Payment will be made for acceptable measured quantity of reinforcement on the basis of unit rate per ton or kg quoted in the bill of quantities and shall constitute full compensation for all the works related to the item.

5.7 BRICK MASONRY

5.7.1 GENERAL

Brick Masonry shall consist of all work required in connection with constructing brick masonry at locations shown on drawings including, but not limited to, furnishing brick, portland cement and sand for mortar and all other materials, and mixing, placing brick masonry as per bill of quantities.

5.7.2 MATERIALS

All portland cement for mortar shall be furnished by the Contractor and shall conform to the applicable requirements specified in the section "Plain and Reinforced Concrete". All sand for mortar shall be furnished by the Contractor and shall conform to the applicable requirements for sand specified in the section "Plain and Reinforced Concrete".

All water used in the manufacture of bricks and in the preparation of mortar shall be free from objectionable quantities of silt, organic matter, alkali, salts and other impurities,

and will be tested and approved by the Project Engineer as per the guidelines of IS: 456.

5.7.3 MORTAR

a. MIX: Mortar for all brick masonry, expect where otherwise directed by the Project Engineer, shall consist of one part cement to six parts of damp loose mortar sand by volume for brickwork 230mm and above. For brick piers, half brick walls, honeycombed brickwork and hollow (cavity) walls, the mortar mix shall consist of one part cement and four parts of sand. Quantity of water shall be just sufficient enough to produce proper consistency for the intended use. Where directed and approved by the Project Engineer, hydrated lime putty, shall be added to the mortar for increased workability. The putty shall, however, not exceed 25% by volume of the dry cement.

b. Methods and equipment used for mixing mortar be such as will accurately determine and control the amount of each separate ingredient entering into the mortar and shall be subject to the approval of the Project Engineer. Mortar shall be mixed only in sufficient quantities for immediate use and all mortar not used within 30 minutes after addition of the water to the mix shall be wasted. Re-tempering of mortar will not be allowed. The mixers shall be thoroughly cleaned and washed at the end of each day's work.

5.7.4 BRICK

a. All bricks shall be of first class quality made from good brick earth, free from saline deposits and shall be sand moulded. They shall be thoroughly burnt without being vitrified, shall be regular, uniform in shape and size with sharp and square edges parallel faces and of deep red or copper colour. First class bricks shall be homogeneous in texture and emit a clear ringing sound when struck, and shall be free from flaws, cracks, chips, stones and nodules of lime. First class brick in an oven dried condition shall not absorb more than 1/5 of its weight of water when immersed for one hour in water at 21 to 27 degrees centigrade and shall show no signs of efflorescence on subsequent drying. The average compressive strength of five representative first class bricks shall be 15N/mm. sq. and shall no result shall fall below 10 N/mm sq. The bricks in general shall conform to the requirements of IS: 1077.

b. All bricks shall be manufactured by the Trench Kiln method or other standard methods approved by the Project Engineer. The earth used in manufacturing bricks shall be carefully selected and shall be free from objectionable quantities of lime, gravel coarse sand, roots, or other organic matter salts shall not exceed 0.3% and calcium carbonate shall not exceed 2.0%.

c. The moulds used in the manufacture of bricks shall be thoroughly sanded before each use and shall be sufficiently larger than the size of the bricks being manufactured to allow

for shrinkage in drying and burning. The size ready for use shall be 9" by 4 3/8" by 2 3/4" (229X 112X 70mm) and shall weigh between 3.2 to 4.2 Kilograms. All bricks shall have a "Frog" 1/4" deep on one face.

5.7.4.1 PLACING

a. The methods and equipment used for transporting the bricks and mortar shall be such as will not damage the brick nor delay the use of mixed mortar. Brick shall not be placed during rains sufficiently heavy or prolonged to wash the mortar from the brick. Mortar which becomes diluted by rain shall be removed and replaced before continuing with the work. All bricks to be used in brick masonry shall be moistened with water for three to four hours before they are used. The chosen method of wetting shall ensure that all bricks are thoroughly and uniformly wetted. All bricks shall be free from water adhering to their surface when they are placed in the brick masonry.

b. Bricks shall be laid "Frog" upward with mortar joints and in English bond as directed by the Project Engineer. Both bed and vertical joints shall be 6mm in thickness completely filled with cement mortar as specified herein, and each brick shall be bedded by firmly tapping with the handle of the trowel. All horizontal joints shall be parallel and all vertical joints in alternate courses shall be directly over one another. Excess mortar at the outer edges shall be removed and joints drawn straight with the edge of a trowel and a straight edge. All anchors and similar work required to be embedded in the brick masonry shall be installed as the work progresses. At the completion of the work all holes or defective mortar joints shall be cut out and repointed.

c. The exterior faces of the walls shall be finished by striking the joints as the work proceeds. The joints shall be struck by raking the green mortar after the brick work has been laid and finishing the joint with a pointing tool. Horizontal joints shall be struck to form weathered joints and vertical joints shall be struck with a V notch. Care shall be taken that the striking tools do not develop a cutting edge as the object of striking the joint is to compress the mortar into the joints.

5.7.5 CURING AND REPAIR

a. All brick masonry shall be water cured and shall be kept wet for least seven days by an approved method which will keep all surfaces continuously wet. Water used for curing shall meet the requirements of these specifications for water used in the manufacture of bricks.

b. If, after the completion of any brick masonry work, the brick are not in alignment or level or does not conform to the lines and grades shown on the drawings, or shows a defective surface, it shall be removed and replaced by the Contractor at his expense unless the Project Engineer grants permission, in writing to patch or replace the defective area.

5.7.6 TOLERANCES

The brickwork shall be erected plumb and true to line at level with the maximum variation in any storey height of any length of wall being one meter. The maximum tolerance in the length, height or width of any single masonry unit shall be +/- 3mm.

5.7.7 MEASUREMENT AND PAYMENT

5.7.7.1 GENERAL

Except otherwise specified herein or elsewhere in the contract documents, the measurement and payment will be made for the under mentioned specified works related to the relevant items of the bill of quantities.

5.7.7.2 MEASUREMENT

Measurement of acceptable completed works of brick masonry will be made on the basis of cubic meters provided and installed in position as shown on the drawing or as directed by the Project Engineer.

5.7.7.3 PAYMENT

Payment will be made for acceptable measured quantity of brick masonry on the basis of unit rate per cum quoted in the bill of quantities and shall constitute full compensation for all the works related to the items.

5.8 FINISHING

5.8.1 GENERAL

5.8.1.1 All plaster work shall be of the best workmanship and in strict accordance with the dimensions of the drawings. All plastering shall be finished to true levels including plumbs, without imperfections, and square with adjoining work. It shall form proper foundations for finishing materials such as paint etc. Masonry and concrete surface to which plaster is to be applied shall be clean, free from efflorescence, sufficiently rough and keyed to ensure proper bond.

5.8.1.2 All chasing, installation of conduits, boxes, etc. shall be completed before any plastering is commenced on a surface. Chasing or cutting of plaster will not be permitted. Broken corners shall be cut back less than 150 mm on both sides and patched with plaster of Paris as directed. All corners shall be rounded to a radius. Contractor shall get samples of each type of plaster work approved by the Architect/Project Manager.

5.8.1.3 All chasing, installation of conduits, boxes, etc. shall be completed before any plastering is commenced on a surface. Chasing or cutting of plaster will not be permitted. Broken corners shall be cut back less than 150 mm on both sides and patched with plaster of Paris as directed. All corners shall be rounded to a radius. Contractor shall get samples of each type of plaster work approved by the Architect/Project Manager.

5.8.1.4 The materials used for plastering shall be proportioned by volume by means of gauge boxes. Alternatively it may be required to proportion the materials by weight.

5.8.2 PLASTER WORK

5.8.2.1 The joints in the brick work, concrete blocks, shall be raked to a depth of 15 mm while the masonry is green. Concrete surfaces to receive plaster shall be suitably roughened. All walls shall be washed with water and kept damp for 10 hours before plastering.

5.8.2.2 The plaster unless specified otherwise shall be average of 12 mm thick on walls. The finished texture shall be as approved by the Architect/Project Manager. The mix for plaster unless otherwise specified, shall be one part cement and four parts sand, to walls and one part cement, 3 parts sand to ceiling.

5.8.2.3 The interior plaster shall be applied in one coat only. The surface shall be trowelled smooth to an approved surface. All plaster work shall be kept continuously wet for seven days

5.8.2.4 The external plaster shall be of two coats on an overall thickness of minimum 20 mm. Preparations of walls to receive plaster work shall be the same as in internal plaster. Backing coat shall be 12 to 15 mm thick with cement mortar 1:5 and finishing coat shall be with cement mortar 1:3.

Backing coats shall be combed on wet surface to form keys for finishing coat. All external plaster shall be waterproofed with approved water proofing powder added to cement in proportion of 1.5 Kg. to 50 Kg. of cement as per the manufacturers' instruction, for both the coats. Cost of waterproofing powder per Kg. shall be paid for separately.

5.8.2.5 For sand faced cement plaster, the finishing coat shall be in cement mortar 1:3, sand used shall be of selected color, properly graded and washed so as to give a grained texture. Finishing plaster coat shall be 8 mm thick, uniformly applied and surface finished with special rubbing by sponge pads and other tools and recommended by the Architect/Project Manager.

5.9 Structural design of RCC elements

The design aims to achieve an acceptable probability that structures being designed will perform satisfactorily during their intended life. With an appropriate degree of safety, they should sustain all the loads and deformations of normal construction and use and have adequate durability and resistance to the effects of earthquake, wind as well as misuse and fire. Structures and structural elements will be designed by Limit State Method. Due consideration will be given to the accepted theories, experience and modern design philosophy and practices

a. Concrete

- **Cement**

Generally Ordinary Portland cement (OPC) conforming to IS: 8112 or Portland pozzolana cement conforming to IS: 1489 shall be used for superstructure.

- **Reinforced Cement Concrete (RCC)**

Reinforced concrete conforming to Table 2; IS 456-2000 shall be used with 20mm and down size graded crushed stone aggregate unless noted otherwise. Recommended minimum grade of reinforced cement concrete shall be M25. Recommended grades for the different members are as follows:

- Beams and Slabs M25
- Columns and Shear walls M25
- Footings & Raft M25
- Water Tanks M25
- Retaining Walls M25

The contractor has to submit the detailed methodology including quality control measures for the manufacture and supply of concrete to the project site and take prior approval of the client before proceeding.

- **Lean Concrete**

Concrete of minimum 100 mm thickness of lean concrete mix 1: 2 :4 (by weight, using 20mm and down size grade crushed stone aggregate) shall be provided under all RCC foundations.

b. Reinforcement bars

- High Strength Deformed Thermo mechanically treated (TMT) Steel bars of grade Fe 500D, conforming to IS: 1786 with minimum elongation of 14.5% and of approved make listed in the tender document shall be used.

- No re-rolled reinforcement bars shall be used.
- Mechanical couplers for laps of bars higher than 32 mm diameter shall be done as per IS 16172.

c. Durability of concrete

Minimum recommended Grade of Concrete for major structural elements for exposed surface conditions is M25. Nominal covers shall not be less than 40 mm from durability point of view. This is applicable for all RCC elements exposed to environment. For the RCC elements sheltered within the façade envelope, the nominal covers shall not be less than 30 mm from durability point of view. Fire resistance period of all building is minimum 2 hours.

The minimum clear cover for various structural elements is to be as follows:

Table 4: Minimum Clear Cover of structural elements

❖	Slab	(simply supported) (continuous)	35mm 25mm
❖	Beams (Roof & floor)	(simply supported) (continuous)	40mm 30mm
❖	Tie beam	Tie beam	40mm
❖	Columns/Pedestals	(Main R/F)	40mm
❖	Foundation	(Bottom) (Top & side)	50mm 50mm
❖	RCC wall	RCC wall	40mm
❖	Water retaining structures		50mm

d. Minimum / maximum thickness of structural concrete elements

- Beam width 200 mm / 750 mm.
- Floor slabs, Roof slabs 125 mm / 300 mm.
- Columns 300 mm / 900 mm.
- Wall thickness (0.4%≤p≤1.0%) 160 mm / 300 mm.

The following minimum / maximum thickness shall also be followed:

- Ground floor slab (non-suspended) 125mm / 300 mm.
- Footings (All types including raft foundations) 300 mm /as required.
- Liquid retaining structures 200 mm / 400 mm.
- Basement walls 200 mm / 400 mm.
- Parapets, Chajjas 125 mm / 200 mm.

- Cable/ Pipe trenches, under-ground pit 125 mm / 250 mm.
- Precast Trench Cover/ Floor Slab 100 mm / 250 mm.

e. Construction joint

Construction joints and shrinkage strips to be planned by the contractor, at design stage (as per IS code: 3414) itself and only be used in locations pre-approved by consultants. Water stops shall be provided in all construction joints below ground level in addition to any joint which may be detailed on the drawing.

f. Expansion joint

To relieve the structure from temperature stresses, expansion joints are provided at several locations as per the requirements. As per BIS code requirement expansion joints are proposed if the length of the structure exceeds 45m. Depending upon geometry of building and for lateral load resisting system expansion joint may be at a distance larger than that recommended by IS codes. Gap for the expansion / separation joint shall be provided as per the provisions mentioned in IS 1893 part IV. As the dimensions of the CCC building is within the limit of expansion joint provided by code there is no such requirement of expansion joint in this structure.

g. Permissible deflections

Permissible deflections shall be as per IS: 456 clauses 23.2. Total deflection of various structural members shall be calculated as per ANNEX C of IS 456. Provisions of IS 1893 and IS 875 shall be followed for lateral deformations.

- The final vertical deflection due to all loads including the effects of temperature, creep and shrinkage and measured from the as-cast level of the supports of floors, roofs and all other horizontal members should not normally exceed span/250.
- The part deflection including the effects of temperature, creep and shrinkage should not normally exceed span/350 or 20 mm whichever is less.
- Under wind load, the lateral sway at the top of building should not exceed height/500.

h. Crack width

Various structural members shall be designed for crack width mentioned as below as per clause no. 35.3.2, IS 456:2000 & clause no. 4.4.1.2, IS 3370(Part-2):2009.

- For structural members exposure to serve exposure condition = 0.1mm
- For water retaining structures = 0.2 mm
- For members exposed to soil or ground water = 0.2 mm
- All other structural members = 0.3 mm

5.10 Design loads

The design of various structural members for this building should follow the following loads and also effects due to shrinkage, creep, temperature, etc., where applicable.

5.10.1 DEAD LOAD

The dead loads should be calculated on the basis of unit weights of materials given in IS: 875 (Part 1). The dead load considered in the structural design shall consist of the full weight of all known fixed structural and architectural elements. The weight of fixed service equipment excluding their contents such as heating, ventilating and air conditioning systems and the weight of all process equipment including all fixtures (conduit, cable tray, ductwork, etc. permanently attached to the structure) and attached piping but excluding their contents should be considered in dead load. The data provided by the project architect and other service consultants should be used for the specific material/equipment.

Unless otherwise specified; the unit weight of materials will be used as follows.

	Particulars	Weight
❖	Reinforced concrete	25.00 kN/m^3
❖	Plain concrete	24.00 kN/m^3
❖	Light weight concrete	12.00 kN/m^3
❖	Concrete block work	18.00 kN/m^3
❖	Brickwork	20.00 kN/m^3
❖	Autoclaved Aerated Concrete Blocks	8.00 kN/m^3
❖	Stone cladding	25.00 kN/m^3
❖	Floor finishes	20.00 kN/m3
❖	Glass	23.50 kN/m^3
❖	Structural steel	78.50 kN/m^3
❖	Water	09.81 kN/m^3
❖	Dry Soil	16.00 kN/m^3
❖	Saturated Soil (Garden load with roots)	21.00 kN/m^3

Typical dead loads considered in the design are as follows:

- Self-weight of slabs, beams, columns & walls - As per sectional sizes of the members.

Additional dead loads

- Floor finishes at Typical floors -1.5 kN/m2
- Water Proofing at Terrace (BBC waterproofing) -3.0 kN/m2

i. Live load

All the live loads should be followed as per IS: 875 (Part 2). In general, following loads reproduced from the code by the use/ occupancy of a building or structure shall be the minimum considered in the designs.

	Loading Area	Load Intensity (KN/m²)
❖	All Rooms	2.00
❖	Balconies, Corridors, passages, lobbies and staircases including fire escapes – as per the floor serviced (excluding stores)	3.00
❖	Toilets and Bath Rooms	2.00
❖	Roof (as it is an accessible roof)	1.50
❖	Terrace Roof Slab (with Solar Panel)	3.00
❖	Multipurpose Hall	5.00
❖	Storage Area	5.00
❖	Play area, Paved Area, Landscape/ Lawn	5.00
❖	Lobby, Footpath, Utility Area	5.00
❖	Car Parking Area/Ramp	5.00
❖	Drive ways of Podium level	15.00
❖	Electrical Meter room	5.00
❖	Mechanical room	5.00
❖	Pump house	5.00

In addition to the live/imposed loads specified above, loads by dynamic effect of machinery (if any) shall be considered. The loads due to the machinery and equipment shall be as specified by the

manufacturer and if it exceeds to above then actual loads shall be considered. Resonant conditions shall be avoided by suitably proportioning the supporting structural members

j. Wind load (wl)

All buildings and structures should be designed to withstand the forces of wind pressure, assumed in any horizontal direction with no allowance for the effect of shielding by other adjacent structures, in accordance with the appropriate provisions of IS: 875 (Part 3).

- Basic Wind speed for Guwahati: Vb = 50 m/sec
- Design Wind Speed at any height : Vz = K1 K2 K3 Vb m/sec Clause 5.3

Where; K1 = Probability factor = 1.0

K2 = Terrain height & structure size factor

- For Category 1 and Class of structures - Class B, Values of Table 2 of IS: 875-Part 3 to be referred.

K3 = Topography factor = 1.0

- Design Wind Pressure at any height : Pz = 0.6 x Vz2 N/m2 Clause 5.4

Based on the above wind pressure and exposure of the building, further load calculations will be carried out with respect to profile of building as per IS: 875 (Part 3).

k. Seismic load (sl)

All buildings, structures, foundations should be designed to resist the effects of earthquakes in accordance with IS: 1893 - Criteria for Earthquake Resistant Design of Structures for Design Basis Earthquake. The structure is primarily column/ shear wall and beam framing system and since due considerations will be given to the major suggestions/ clauses from IS: 13920. The frames are to be designed to carry lateral loads but do not fulfill the requirements of 'dual systems' .

Seismic design forces should be determined based upon the following parameters. Buildings of different materials of construction and lateral force resisting systems shall be investigated separately.

l. Seismic weight calculation

The seismic weight of building includes all permanent rigidly attached structural and non-structural components of a building, such as walls, floors, roofs, total weight of permanent equipment etc. The contribution of live load to be considered in the seismic weight calculation shall be taken as per Clause 7.3.1 and as specified in Table – 8 of IS 1893 (Part 1).

m. Permissible stresses

- Whenever seismic forces are considered along with other normal design forces, the permissible stresses in material shall be governed by the respective codes as per which the structure/ equipment is being designed.

- For the other provisions of the code Cl.No.6.3.5 of IS: 1893 (part-1) and Cl.No. 7.4 of IS: 1893 (Part-4) shall be followed.
- Earthquake loads shall not be considered to act simultaneously with wind.

n. Ductile detailing

The ductility details of reinforced concrete members should be provided as per the provisions of IS: 13920 to avoid premature failure during earthquake.

o. Impact loads

- All structural framing and concrete foundations subject to vibration, impact, impulse, shock, etc., shall be designed to withstand the generated forces within the limits of acceptable stress, deflection, and/or amplitude of vibration.
- All structures supporting reciprocating equipment or rotating equipment with excessive imbalance shall be analysed for both strength and response.
- All structures supporting moving or stationary equipment shall be designed for static loads plus an appropriate impact factor as defined by the equipment manufacturer IS: 875, IS: 2974.

p. Wheel load

For any structure or pipeline below roads, IRC Class of loading for which the road has been actually designed will be considered.

a) Surcharge load

Minimum surcharge of 10KN/m2 and as per IRC whichever is higher shall be considered for design of all underground structures to take in to account the construction load and vehicular traffic in the vicinity of structure. The soil parameters and ground water table will be considered as per soil investigation report.

b) Earth pressure

Earth pressure for walls of basement/ tanks etc. with propped support condition will be calculated using coefficient of earth pressure at-rest. Earth pressure for cantilever walls like cable trenches will be calculated based on active earth pressure. Unit weight of soil shall be as per section 8.1. Other soil parameters such as cohesion and angle of internal friction shall be considered as per soil investigation report.

c) Hydrostatic pressure

If envisaged, the ground water load shall be applied on the substructure as super imposed dead load in addition to the earth pressure. The dry density of soil shall be considered in this combination.

d) Construction loads

Loads produced by the materials of construction plus the equipment required to construct the facility (crane loads, rigging loads, earth moving equipment, etc.) as applicable shall be considered. When the sequencing of construction will not permit the lateral force resisting system of the structure to be constructed first, the engineer shall make provisions for temporary lateral bracing and clearly identify these requirements on the design drawings and contract documents. The Contractor shall coordinate the sequence of building erection and the types and quantity of construction equipment to be used.

e) Load combinations

Each element of a building or structure shall be provided with sufficient strength to resist the most critical effects resulting from the following combination of loads.

Load cases and load combination shall be as follow:

a) Static load cases

- Dead load (DL)
- Live load (LL)
- Wind load in X direction (WLX)
- Wind load in Y direction (WLY)
- Seismic load (Spectra) in X-direction (EQX)
- Seismic load (Spectra) in Y-direction (EQY)

(X and Y directions are mutually orthogonal in plan area, to define the direction of seismic forces with reference to building)

The design shall be governed by worst load combinations, keeping in view the probability of

- Each load case acting together and Their disposition in relation to other loads and severity of stresses or deformations caused by combinations of the various loads is necessary to ensure the required safety and economy in the design of a structure.

The allowable stresses and soil bearing values shall not be increased for any condition of dead, live loads acting alone or in combination with each other.

6 GENERAL REQUIREMENTS

The work shall be executed on Item rate basis. Details and drawings given in Tender document is to be followed by the successful bidder. The bidder shall undertake confirmatory survey for accuracy and completeness of data. Scope of work mentioned is for indicative and

exhaustive purpose. In addition the contractor shall be responsible for executing all items required for completing the tendered works as per direction of Engineer-in-charge.

a. The contractor will have to construct according to the layout plan and detailed architectural drawings approved by HDMC.

b. The structural drawing shall be approved by HDMC. If any modification in design/ drawing as per R & B guideline is needed, due to site conditions, the agency shall do/ redo itself without any extra cost. The decision of the Municipal Commissioner shall be final and binding. No claim what so ever will be entertained in this regard.

c. Agency has to obtain labour license from Respective Department.

d. Fire safety norms shall be followed as per Standards.

e. Setting of testing laboratory at site, equipped with apparatus needed for testing during construction. All the required tests as instructed by Engineer-In-Charge shall be carried out.

f. After completion of Contract period, the crematorium will become the property of the HDSCL. The Contractor shall handover the crematorium in Good working conditions complete to the satisfaction of Authority.

g. HDSCL reserves the right to inspect the crematorium at any time during the contract period.

h. Taking all precautionary measure to safeguard against any accident for the contractors employees, general public, supervisory staff of HDMC by providing necessary safety equipments, helmets and MS sheet barricading etc. at work site. The site has to be kept clean all the time of all debris, rubbish, dirt & surplus/waste material.

7 OTHER REQUIREMENTS

a. All the successful Contractors will have to ensure meeting of the design criteria.

b. Any deviation from the proposed design needs to be approved by the HDSCL.

7.1 TESTING AND INSPECTION

a. Third Party inspection

b. The charges for third party inspection, if any, would initially be borne by the Contractor.
c. Site tests
d. After erection at site, all components, equipment as described shall be tested to prove satisfactory performance and /or fulfillment of functional requirements without showing any sign of defect as individual equipment and as well as a system.

SI. NO.	DWG. NO.	ISSUE	DRAWING TITLE
	ELECTRIC CREMATORIUM		
01	TCE.10753A–CV–3001–RC–40102	P0	FOOTING LAYOUT OF ELECTRIC CREMATORIUM
02	TCE.10753A–CV–3001–RC–40103	P0	COLUMN LAYOUT OF ELECTRIC CREMATORIUM
03	TCE.10753A–CV–3001–RC–40104	P0	TYPICAL REINFORCEMENT DETAILS FOR FOOTING AND COLUMN OF ELECTRIC CREMATORIUM
04	TCE.10753A–CV–3001–RC–40105	P0	PLINTH BEAMS LAYOUT OF ELECTRIC CREMATORIUM
05	TCE.10753A–CV–3001–RC–40106	P0	ROOF BEAMS LAYOUT OF ELECTRIC CREMATORIUM
06	TCE.10753A–CV–3001–RC–40107	P0	TYPICAL REINFORCEMENT DETAILS FOR ROOF BEAMS OF ELECTRIC CREMATORIUM
07	TCE.10753A–CV–3001–RC–40108	P0	ROOF SLABS LAYOUT OF ELECTRIC CREMATORIUM
08	TCE.10753A–CV–3001–RC–40109	P0	TYPICAL REINFORCEMENT DETAILS FOR ROOF SLABS OF ELECTRIC CREMATORIUM
09	TCE.10753A–CV–3001–RC–40110	P0	PLAN AND ELEVATION FOR ELECTRIC CREMATORIUM
10	TCE.10753A–CV–3001–RC–40111	P0	GENARAL ARRANGEMENT DRAWING FOR SEATING ARRANGEMENT
11	TCE.10753A–CV–3001–RC–40112	P0	RETAINING WALL FOR ELECTRIC CREMATORIUM
12	TCE.10753A–AC–1018–LP–10100	P0	GENERAL LAYOUT OF ELECTRIC CREMATORIUM
13	TCE.10753A–AC–1022–AC–10050	P0	GROUND FLOOR PLAN,SECTION & ELEVATIONS OF ELECTRIC CREMATORIUM
14	TCE.10753A–AC–1000–AC–10051	P0	SITE PLAN OF ELECTRIC CREMATORIUM
15	TCE.10753A–AC–1000–AC–10052	P0	LOCATION PLAN OF ELECTRIC CREMATORIUM
16	TCE.10753A–EL–4026–GL–40100	P0	SINGLE LINE DIAGRAM OF ELECTRIC CREMATORIUM
17	TCE.10753A–EL–4026–GL–40101	P0	LIGHTING LAYOUT OF ELECTRIC CREMATORIUM

	SIGN.													
	INITIALS													
	REVISIONS													
P0	SIGN.													
	INITIALS													
	REVISIONS													
ISSUE		DRN	DSN	CHD	CV	EL	IC	ME			PE/PM	APPD	DATE	
					CLEARED									

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CONSTRUCTION / FABRICATION WORK IS PERMITTED ON 'R' (RELEASED) ISSUES ONLY.

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FOR APPROVAL

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FILE NAME: List of Drawing_Electric Crematorium.dwg

HUBBALI–DHARWAD SMART CITY LTD

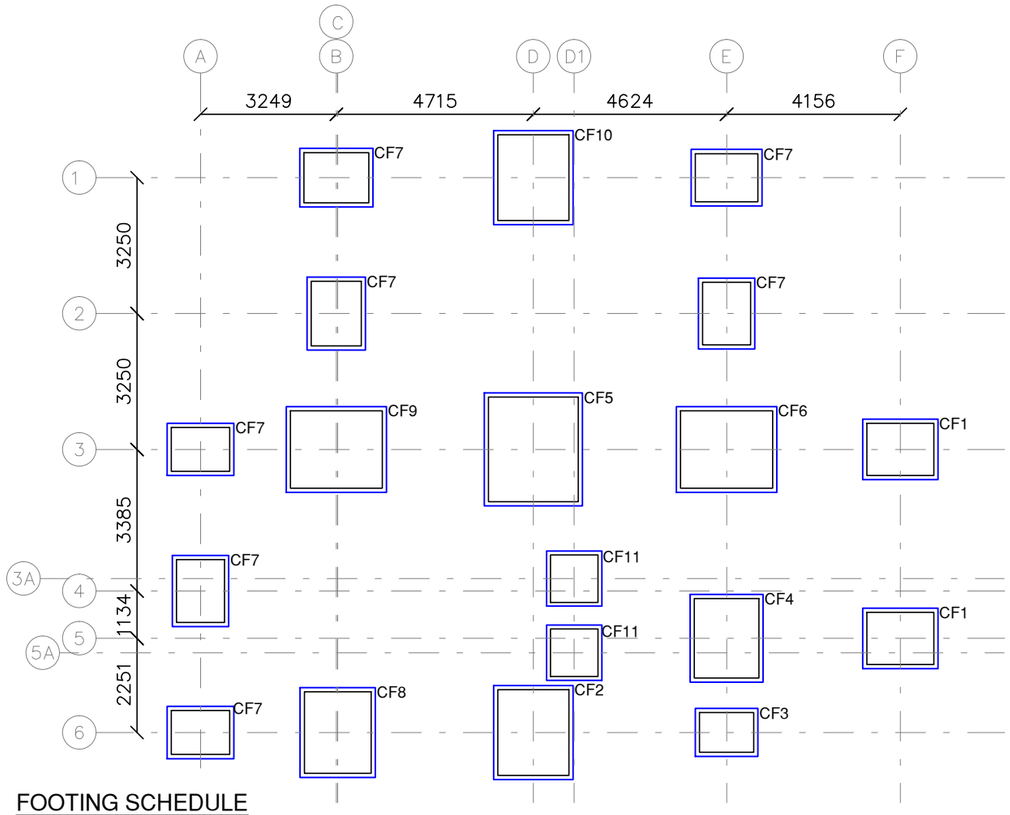
LIST OF DRAWING FOR ELECTRIC CREMATORIUM

TATA CONSULTING ENGINEERS LIMITED

IN ASSOCIATION WITH

PRICEWATERHOUSE COOPERS PRIVATE LIMITED

SCALE :	DWG NO.	ISSUE
DC & DISC: BLR & CV		P0



NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETRES AND LEVELS ARE IN METERS UNLESS OTHERWISE NOTED.
2. UNLESS MENTIONED OTHERWISE CEMENT SHALL BE ORDINARY PORTLAND CEMENT GARDE OF 43 CONFIRMING TO IS:269
3. STRUCTURAL CONCRETE SHALL BE OF M25 GRADE WITH 20MM DOWNGRADED COARSE SIZE UNLESS NOTED.
4. BACK FILLING SHALL BE DONE IN UNIFORM LAYERS OF 150mm AND EVENLY ALL ROUND THE STRUCTURE.
5. IF ANY BLACK COTTON SOIL ENCOUNTERED SAME SHALL BE REPLACED BY WELL COMPACTED SOIL, SHALL BE COMPACTED TO 95% MODIFIED PROCTOR DENSITY
6. AS PER SOIL INVESTIGATION REPORT NET ALLOWABLE SAFE BEARING CAPACITY OF SOIL CONSIDERED IS 210kN/SQ.M AND SAME TO BE CONFIRMED AT SITE
7. CLEAR COVER TO MAIN REINFORCEMENT SHALL BE AS FOLLOWS.
   - COLUMNS --- 40 MM ALL SIDES.
   - FOOTING --- 50 MM ALL SIDES.
   - WALL --- 40 MM ALL SIDES.
   - BEAM --- 30 MM ALL SIDES.
   - SLAB --- 20 MM ALL SIDES.
8. CLEAR SPACING OF BARS IN DIFFERENT LAYERS SHALL BE EQUAL TO THE MAXIMUM SIZE OF COARSE AGGREGATE.
9. SPLICING LENGTH SHALL BE 50 TIMES THE SMALLER DIAMETER OF THE BAR.
10. DEVELOPMENT LENGTH SHALL BE 50 TIMES THE DIAMETER OF BAR.

FOOTING SCHEDULE

FOOTING	M25:Fe500	SHORT DIR (B)	T10@200c/c	T10@200c/c	T10@200c/c	T10@200c/c	T10@200c/c	T10@200c/c	T10@200c/c	T10@200c/c	T10@200c/c
		LONG DIR (L)	T10@200c/c	T10@200c/c	T10@200c/c	T10@200c/c	T10@200c/c	T10@200c/c	T10@200c/c	T10@200c/c	T10@200c/c
		D	250	300	250	275	375	325	250	275	325
		SIZE	1600 x 1250	2050 x 1700	1300x 950	1900 x 1550	2500 x 2150	2200 x 1850	1550 x 1200	1950 x 1600	2200 x 1850
P.C.C	M15	100 THK	1800 x 1450	2350 x 1900	1500 x 1150	2100 x 1750	2700 x 2350	1800 x 1450	1700 x 1350	1600 x 1250	2400 x 2050
FOOTING MARKED			CF1	CF2	CF3	CF4	CF5	CF6	CF7	CF8	CF9

FOOTING	M25:Fe500	SHORT DIR (B)	T10@180c/c	T10@200c/c
		LONG DIR (L)	T10@170c/c	T10@200c/c
		D	300	250
		SIZE	2050 x 1700	1250 x 1250
P.C.C	M15	100 THK	2250 x 1900	1450 x 1450
FOOTING MARKED			CF10	CF11

HUBBALI–DHARWAD SMART CITY LTD

FOOTING LAYOUT OF
ELECTRIC CREMATORIUM

	SIGN.													
	INITIALS													
	REVISIONS													
P0	SIGN.													10.11.17
	INITIALS	LSD	MBC	UN										
	REVISIONS													
ISSUE		DRN	DSN	CHD	CV	EL	IC	ME			PE/PM	APPD	DATE	
					CLEARED									

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FOR APPROVAL

DO NOT SCALE

FILE NAME: TCE.10753A–CV–40102–40104.DWG

TATA CONSULTING ENGINEERS LIMITED
IN ASSOCIATION WITH
PRICEWATERHOUSECOOPERS PRIVATE LIMITED

SCALE : NTS
DC & DISC: BLR & CV

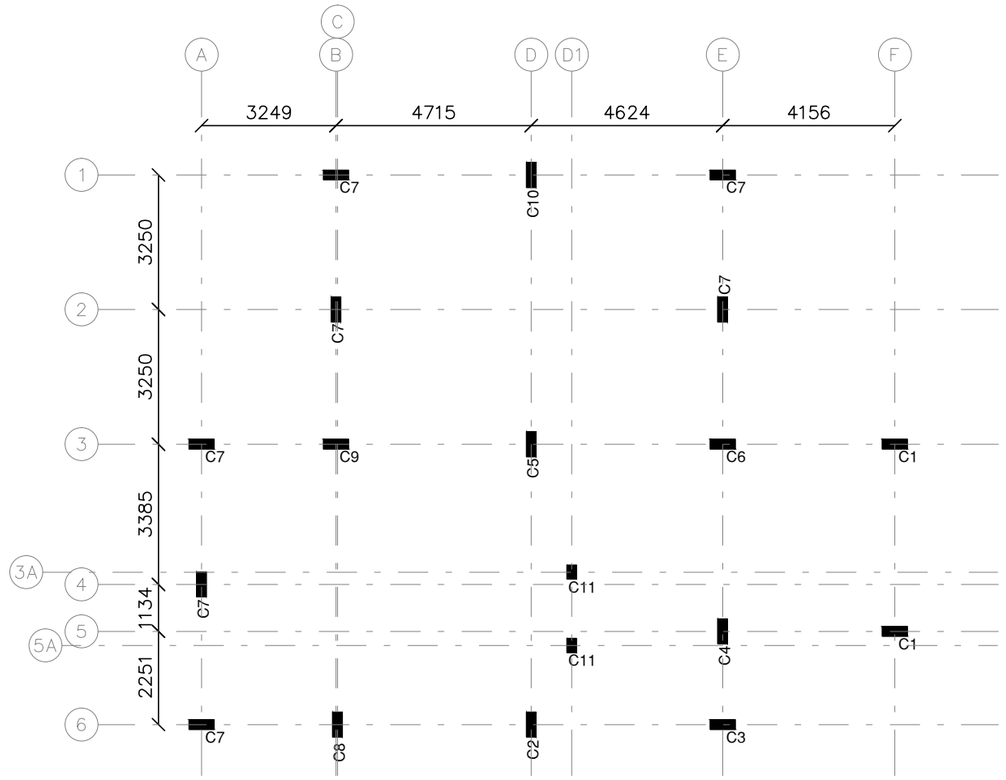
DWG NO. TCE.10753A–CV–3001–RC–40102

ISSUE P0

SIZE–A3

FILE NAME: F–093–Rev–R0.DWG

TCE FORM NO. 093 R0



NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETRES AND LEVELS ARE IN METERS UNLESS OTHERWISE NOTED.
2. UNLESS MENTIONED OTHERWISE CEMENT SHALL BE ORDINARY PORTLAND CEMENT GARDE OF 43 CONFIRMING TO IS:269
3. STRUCTURAL CONCRETE SHALL BE OF M25 GRADE WITH 20MM DOWNGRADED COARSE SIZE UNLESS NOTED.
4. BACK FILLING SHALL BE DONE IN UNIFORM LAYERS OF 150mm AND EVENLY ALL ROUND THE STRUCTURE.
5. IF ANY BLACK COTTON SOIL ENCOUNTERED SAME SHALL BE REPLACED BY WELL COMPACTED SOIL, SHALL BE COMPACTED TO 95% MODIFIED PROCTOR DENSITY
6. AS PER SOIL INVESTIGATION REPORT NET ALLOWABLE SAFE BEARING CAPACITY OF SOIL CONSIDERED IS 210kN/SQ.M AND SAME TO BE CONFIRMED AT SITE
7. CLEAR COVER TO MAIN REINFORCEMENT SHALL BE AS FOLLOWS.
   - COLUMNS --- 40 MM ALL SIDES.
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   - WALL --- 40 MM ALL SIDES.
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   - SLAB --- 20 MM ALL SIDES.
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9. SPLICING LENGTH SHALL BE 50 TIMES THE SMALLER DIAMETER OF THE BAR.
10. DEVELOPMENT LENGTH SHALL BE 50 TIMES THE DIAMETER OF BAR.

COLUMN SCHEDULE

0.9M TO 4.9M	M25:Fe415	SIZE (B X D)	230 X 600	230 X 600	230 X 600	230 X 600	230 X 600	230 X 600	230 X 600	230 X 600	230 X 600
		STEEL	10–T12	10–T16	10–T12	10–T12	10–T12	10–T12	10–T12	10–T12	10–T12
		LINKS	T8 @ 175	T8 @ 175	T8 @ 200	T8 @ 175	T8 @ 175	T8 @ 175	T8 @ 175	T8 @ 175	T8 @ 175
-4.0M TO 0.9M	M25:Fe415	SIZE (B X D)	230 X 600	230 X 600	230 X 600	230 X 600	230 X 600	230 X 600	230 X 600	230 X 600	230 X 600
		STEEL	10–T12	10–T12	10–T12	10–T12	10–T12	10–T12	10–T12	10–T12	10–T12
		LINKS	T8 @ 175	T8 @ 175	T8 @ 175	T8 @ 175	T8 @ 175	T8 @ 175	T8 @ 175	T8 @ 175	T8 @ 175
COLUMN MARKED			C1	C2	C3	C4	C5	C6	C7	C8	C9
0.9M TO 4.9M	M25:Fe415	SIZE (B X D)	230 X 600	230 X 400							
		STEEL	10–T16	10–T12							
		LINKS	T8 @ 175	T8 @ 175							
-4.0M TO 0.9M	M25:Fe415	SIZE (B X D)	230 X 600	230 X 600							
		STEEL	10–T12	10–T12							
		LINKS	T8 @ 175	T8 @ 175							
COLUMN MARKED			C10	C11							

	SIGN.												
	INITIALS												
	REVISIONS												
P0	SIGN.												10.11.17
	INITIALS	LSD	MBC	UN									
	REVISIONS												
SSUE		DRN	DSN	CHD	CV	EL	IC	ME			PE/PM	APPD	DATE
					CLEARED								

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FOR APPROVAL

DO NOT SCALE

FILE NAME:TCE.10753A-CV-40102-40104.DWG

HUBBALI–DHARWAD SMART CITY LTD

COLUMN LAYOUT OF ELECTRIC CREMATORIUM

TATA CONSULTING ENGINEERS LIMITED

IN ASSOCIATION WITH

PRICEWATERHOUSECOOPERS PRIVATE LIMITED

SCALE : NTS

DC & DISC: BLR & CV

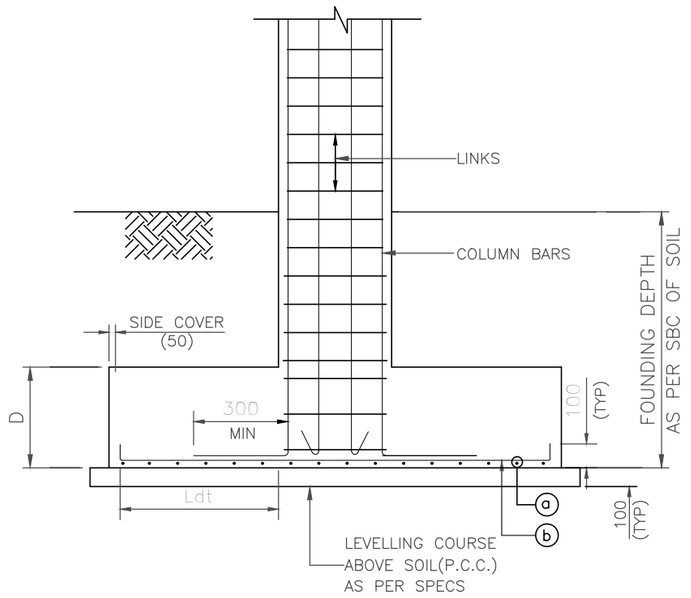
DWG NO. TCE.10753–CV–3001–RC–40103

ISSUE P0

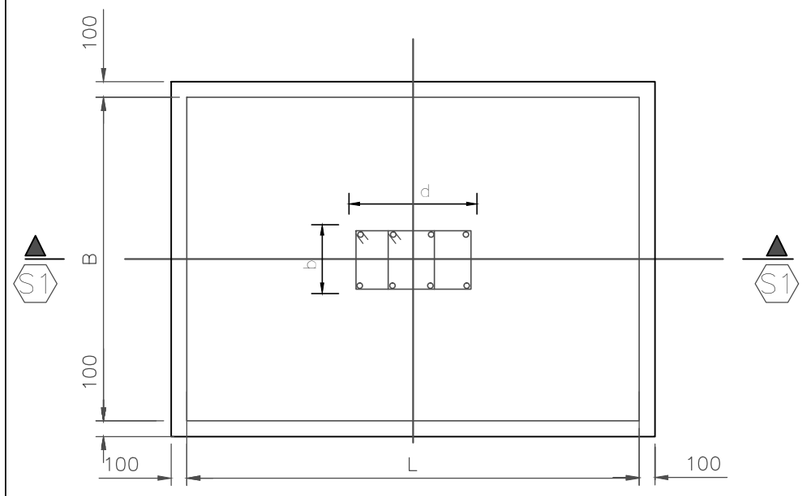
SIZE–A3

FILE NAME: F–093–Rev–R0.DWG

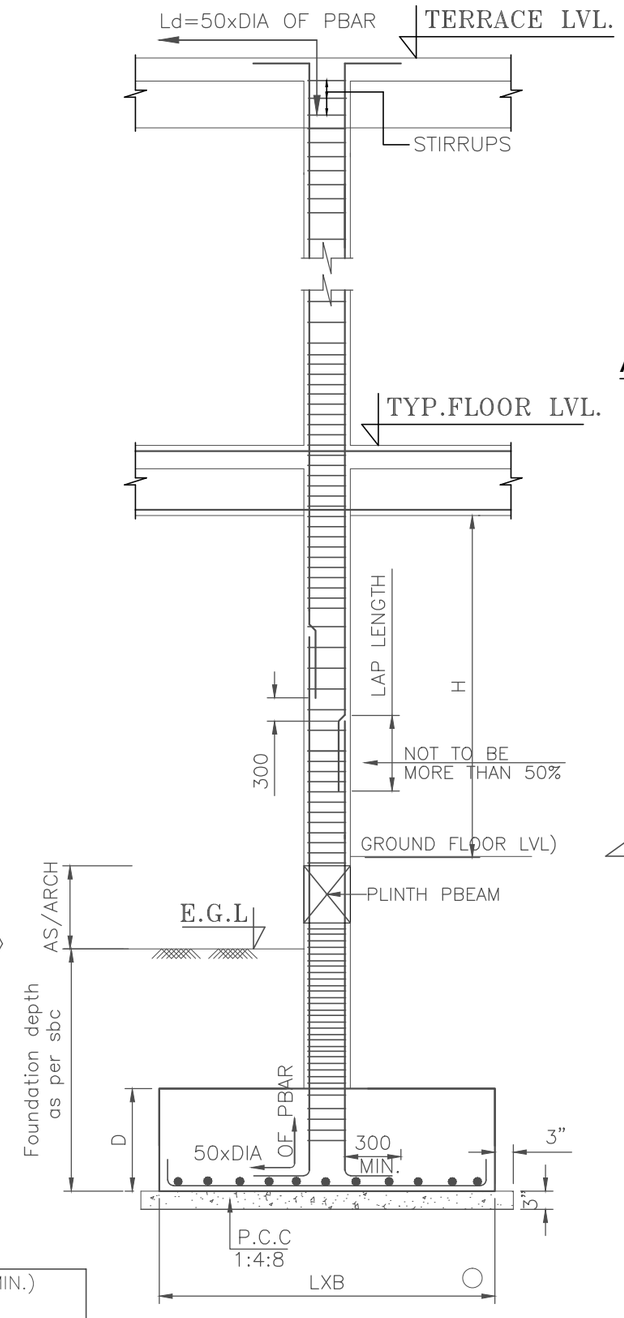
TCE FORM NO. 093 R0



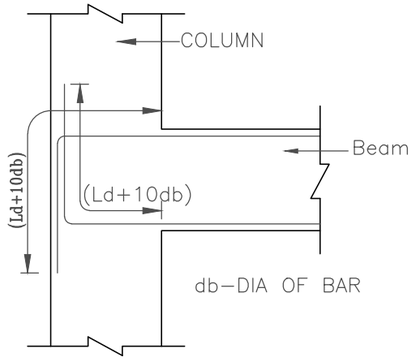
SECTION S1 - S1



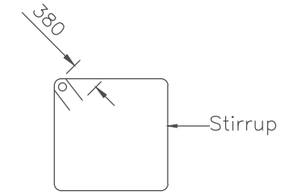
TYPICAL DETAILS FOR PAD FOOTING



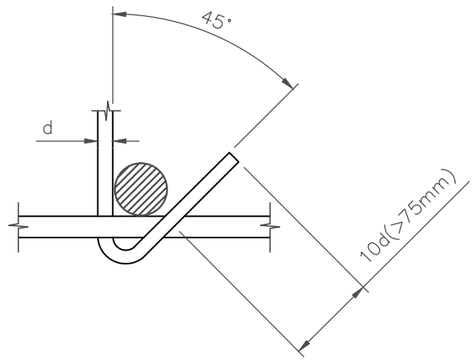
TYPICAL COLUMN SECTION(X-X)



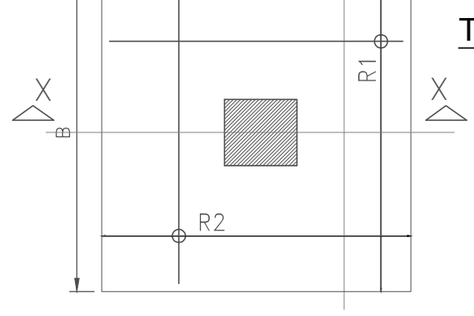
ANCHORAGE OF BEAM BARS AT THE END COLUMNS (N.T.S.)



TYPICAL DETAIL OF STIRRUP BENDING



TYPICAL LINK DETAILS



TYPICAL FOOTING PLAN

– IN LAP PORTION STIRRUPS SPACING SHALL BE 100 mm c/c (MIN.)

* = H/6 OR LARGEST DIM. OF COLUMN OR 450 MM, WHICHEVER IS MAXIMUM.

	SIGN.													
	INITIALS													
	REVISIONS													
	SIGN.													
P0	INITIALS	LSD	MBC	UN										10.11.17
	REVISIONS													
ISSUE		DRN	DSN	CHD	CV	EL	IC	ME			PE/PM	APPD	DATE	
					CLEARED									

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FOR APPROVAL

DO NOT SCALE

FILE NAME: TCE.10753A-CV-40102-40104.DWG

HUBBALI–DHARWAD SMART CITY LTD

TYPICAL REINFORCEMENT DETAILS FOR FOOTING AND COLUMN OF ELECTRIC CREMATORIUM

TATA CONSULTING ENGINEERS LIMITED

IN ASSOCIATION WITH

PRICEWATERHOUSECOOPERS PRIVATE LIMITED

SCALE : NTS

DC & DISC: BLR & CV

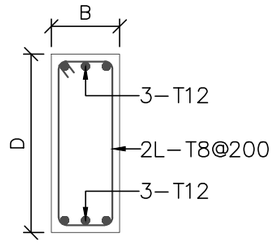
DWG NO. TCE.10753–CV–3001–RC–40104

ISSUE P0

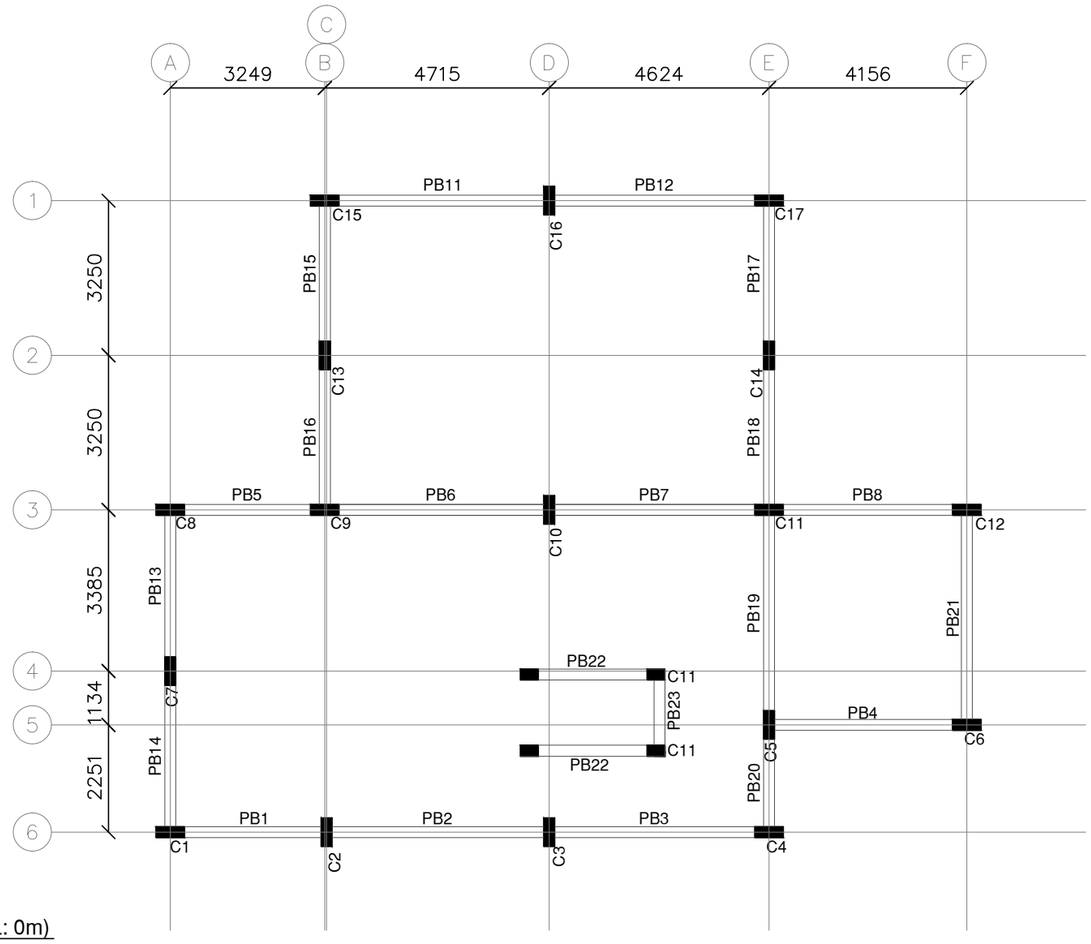
SIZE–A3

FILE NAME: F–093–Rev–R0.DWG

TCE FORM NO. 093 R0



TYPICAL BEAM SECTION
(SCALE 1:20)
(Rebars as per design)



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BEAM SCHEDULE (M25:Fe500) (LEVEL: 0m)

BEAM NUMBERS	SIZE		BOTTOM REINFORCEMENT			TOP REINFORCEMENT			SHEAR STIRRUPS			SFR
	B	D	LEFT	MID SPAN	RIGHT	LEFT	MID SPAN	RIGHT	LEFT	MID SPAN	RIGHT	
PB1,PB2,PB3,PB4,PB5,PB6 ,PB7,PB8,PB11,PB12, PB18,PB19,PB20,PB21	230	600	3–T12	3–T12	3–T12	3–T12	3–T12	3–T12	2L–T8@185	2L–T8@200	2L–T8@185	2–T8 EF
PB13,PB15,PB17	230	600	3–T12	3–T12	3–T12	3–T12	3–T12	3–T12	2L–T8@200	2L–T8@200	2L–T8@185	2–T8 EF
PB14	230	600	3–T12	3–T12	3–T12	3–T12	3–T12	3–T12	2L–T8@200	2L–T8@200	2L–T8@200	–
PB16	230	600	3–T12	3–T12	3–T12	3–T12	3–T12	3–T12	2L–T8@185	2L–T8@200	2L–T8@200	2–T8 EF
PB22,PB23	230	350	3–T12	3–T12	3–T12	3–T12	3–T12	3–T12	2L–T8@185	2L–T8@200	2L–T8@200	2–T8 EF

	SIGN.													
	INITIALS													
	REVISIONS													
P0	SIGN.													10.11.17
	INITIALS	LSD	MBC	UN										
	REVISIONS													
ISSUE		DRN	DSN	CHD	CV	EL	IC	ME			PE/PM	APPD	DATE	
					CLEARED									

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FOR APPROVAL

DO NOT SCALE

FILE NAME: TCE.10753A-CV-40105.DWC

HUBBALI–DHARWAD SMART CITY LTD

PLINTH BEAMS OF ELECTRIC CREMATORIUM

TATA CONSULTING ENGINEERS LIMITED
IN ASSOCIATION WITH
PRICEWATERHOUSECOOPERS PRIVATE LIMITED

SCALE : NTS
DC & DISC: BLR & CV

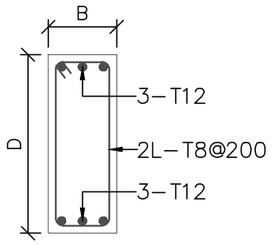
DWG NO. TCE.10753A–CV–3001–RC–40105

ISSUE P0

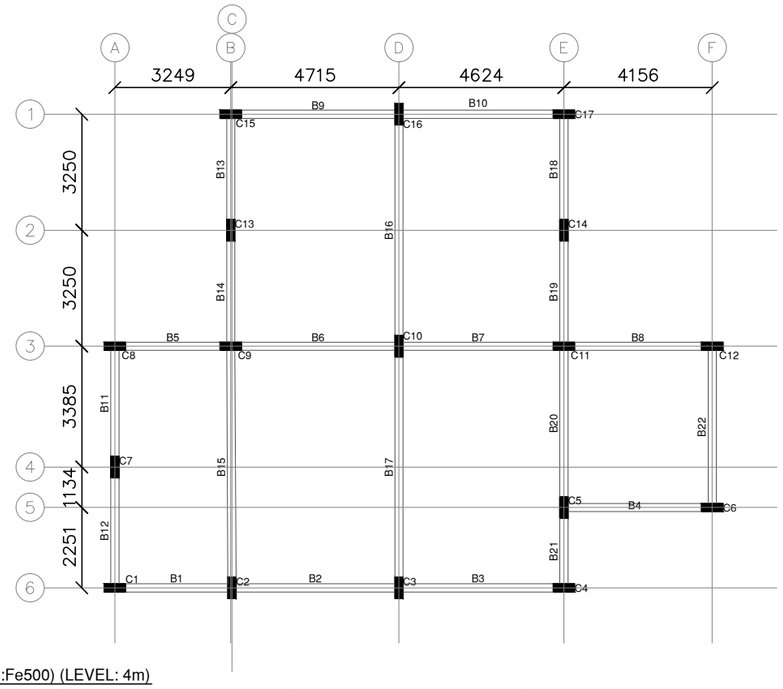
SIZE–A3

FILE NAME: F–093–Rev–R0.DWG

TCE FORM NO. 093 R0



TYPICAL BEAM SECTION
(SCALE 1:20)
(Rebars as per design)



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7. CLEAR COVER TO MAIN REINFORCEMENT SHALL BE AS FOLLOWS.
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   BEAM --- 30 MM ALL SIDES.
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BEAM SCHEDULE (M25:Fe500) (LEVEL: 4m)

BEAM NUMBERS	SIZE		BOTTOM REINFORCEMENT			TOP REINFORCEMENT			SHEAR STIRRUPS			SFR
	B	D	LEFT	MID SPAN	RIGHT	LEFT	MID SPAN	RIGHT	LEFT	MID SPAN	RIGHT	
B1,B3	230	600	3-T12	3-T12	3-T12	2-T16	2-T16	2-T16	2L-T8@185	2L-T8@185	2L-T8@185	2-T8 EF
B2	230	600	3-T12	3-T12	3-T12	2-T16	2-T16	2-T16	2L-T8@185	2L-T8@200	2L-T8@185	2-T8 EF
B4,B22	230	600	3-T12	3-T12	3-T12	3-T12	3-T12	3-T12	2L-T8@185	2L-T8@200	2L-T8@185	2-T8 EF
B5	230	600	3-T12	3-T12	3-T12	3-T12	3-T12	3-T16	2L-T8@185	2L-T8@185	2L-T8@185	2-T8 EF
B6	230	600	2-T16	2-T16	2-T16	3-T16	3-T12	3-T16	2L-T8@185	2L-T8@185	2L-T8@185	2-T8 EF
B7	230	600	3-T12	3-T12	3-T12	3-T16	3-T12	2-T16	2L-T8@185	2L-T8@185	2L-T8@185	2-T8 EF
B8	230	600	3-T12	3-T12	3-T12	2-T16	3-T12	3-T12	2L-T8@185	2L-T8@200	2L-T8@185	2-T8 EF
B9,B10	230	600	3-T12	3-T12	3-T12	3-T12	3-T12	3-T12	2L-T8@185	2L-T8@185	2L-T8@185	2-T8 EF
B11,B18	230	600	3-T12	3-T12	3-T12	3-T12	3-T12	3-T12	2L-T8@200	2L-T8@200	2L-T8@185	2-T8 EF
B12,B19	230	600	3-T12	3-T12	3-T12	3-T12	3-T12	3-T12	2L-T8@185	2L-T8@200	2L-T8@200	2-T8 EF
B13	230	600	3-T12	3-T12	3-T12	2-T16	2-T16	2-T16	2L-T8@200	2L-T8@200	2L-T8@185	2-T8 EF
B14	230	600	3-T12	3-T12	3-T12	2-T16	2-T16	+ 2-T16 2-T16	2L-T8@200	2L-T8@185	2L-T8@185	2-T8 EF
B15	230	600	2-T16	+ 3-T16 2-T12	2-T16	+ 2-T16 2-T16	2-T16	2-T20	2L-T8@185	2L-T8@185	2L-T8@185	2-T8 EF
B16	230	600	2-T16	+ 3-T16 2-T12	2-T16	+ 2-T16 2-T12	2-T16	+ 2-T25 2-T16	2L-T8@185	2L-T8@185	2L-T8@180	2-T8 EF
B17	230	600	2-T16	+ 3-T16 2-T12	2-T16	+ 2-T25 2-T16	2-T16	+ 2-T16 2-T12	2L-T8@200	2L-T8@200	2L-T8@200	-
B20	230	600	2-T16	2-T16	2-T16	3-T12	3-T12	3-T16	2L-T8@185	2L-T8@185	2L-T8@185	2-T8 EF
B21	230	600	3-T12	3-T12	3-T12	3-T16	3-T12	3-T12	2L-T8@185	2L-T8@185	2L-T8@185	2-T8 EF

	SIGN.												
	INITIALS												
	REVISIONS												
PO	SIGN.												10.'1.17
	INITIALS	LSD	MBC	UN									
	REVISIONS												
SSUE		DRN	DSN	CHD	CV	EL	IC	ME			PE/PM	APPD	DATE
					CLEARED								

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FOR APPROVAL

DO NOT SCALE

FILE NAME:TCE.10753A-CV-40106-40107.DWG

HUBBALI–DHARWAD SMART CITY LTD

ROOF BEAMS LAYOUT OF ELECTRIC CREMATORIUM

TATA CONSULTING ENGINEERS LIMITED
IN ASSOCIATION WITH
PRICEWATERHOUSECOOPERS PRIVATE LIMITED

SCALE : NTS
DC & DISC: BLR & CV

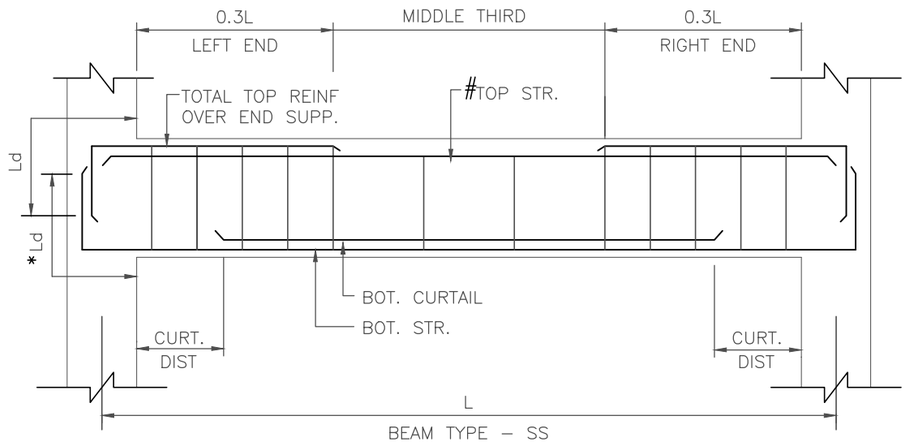
DWG NO. TCE.10753A–CV–3001–RC–40106

ISSUE P0

SIZE–A3

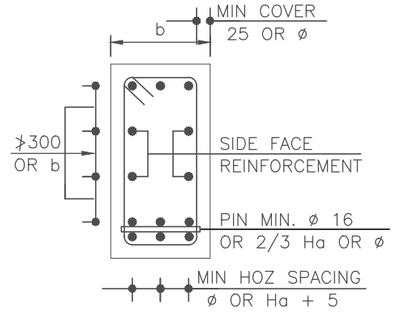
FILE NAME: F–093–Rev–R0.DWG

TCE FORM NO. 093 R0



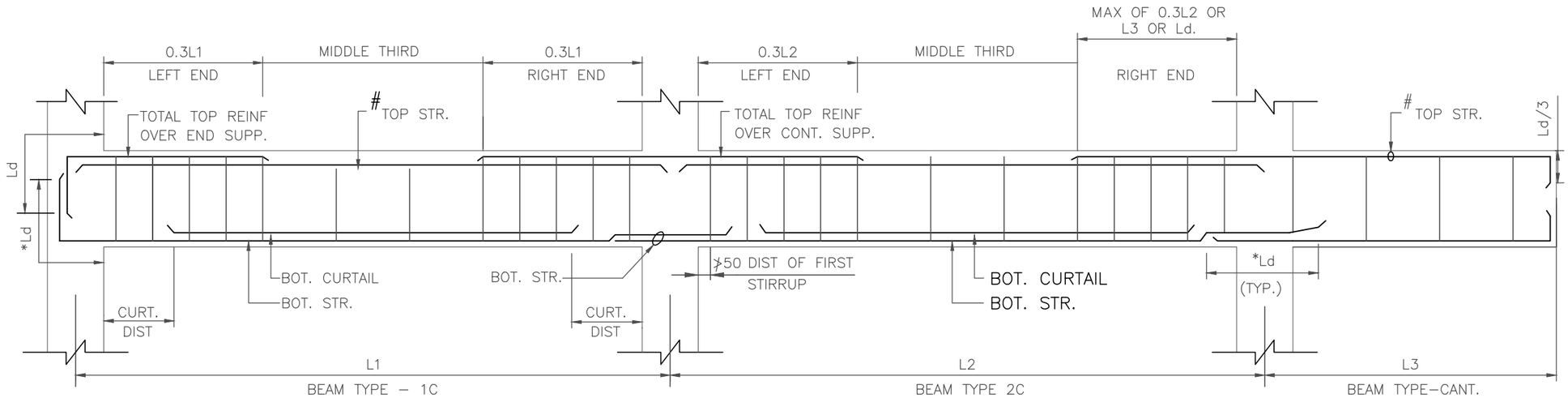
TYP SECTIONAL ELEVATION OF SIMPLY SUPPORTED BEAM

(TYP. REINFORCEMENT DETAILS.)
(SCALE 1:30)



C/S OF BEAM

Ha – MAX. SIZE OF AGGREGATE
(SCALE 1:30)



FB – FRAME BEAM
NFB – NON FRAME BEAM

TYP SECTIONAL ELEVATION OF BEAM

(TYP. REINFORCEMENT DETAILS.)
(SCALE 1:30)

*FOR NON FRAME BEAMS THIS DEVELOPMENT LENGTH SHALL BE Ld/3 OR 300mm WHICHEVER IS MAXIMUM

#IF BAR DIA. OF TOP STR. REINF. IS SAME AS REINF. OVER END/CONT. SUPPORT, CONTINUE THE SAME BAR OVER END/CONT. SUPPORT.

	SIGN.												
	INITIALS												
	REVISIONS												
P0	SIGN.												10.1.17
	INITIALS	LSD	MBC	UN									
	REVISIONS												
SSUE		DRN	DSN	CHD	CV	EL	IC	ME			PE/PM	APPD	DATE
					CLEARED								

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FOR APPROVAL

DO NOT SCALE

FILE NAME:TCE.10753A-CV-40106-40107.DWG

HUBBALI–DHARWAD SMART CITY LTD

TYPICAL REINFORCEMENT DETAILS FOR ROOF BEAMS OF ELECTRIC CREMATORIUM

TATA CONSULTING ENGINEERS LIMITED
IN ASSOCIATION WITH
PRICEWATERHOUSECOOPERS PRIVATE LIMITED

SCALE : AS SHOWN
DC & DISC: BLR & CV

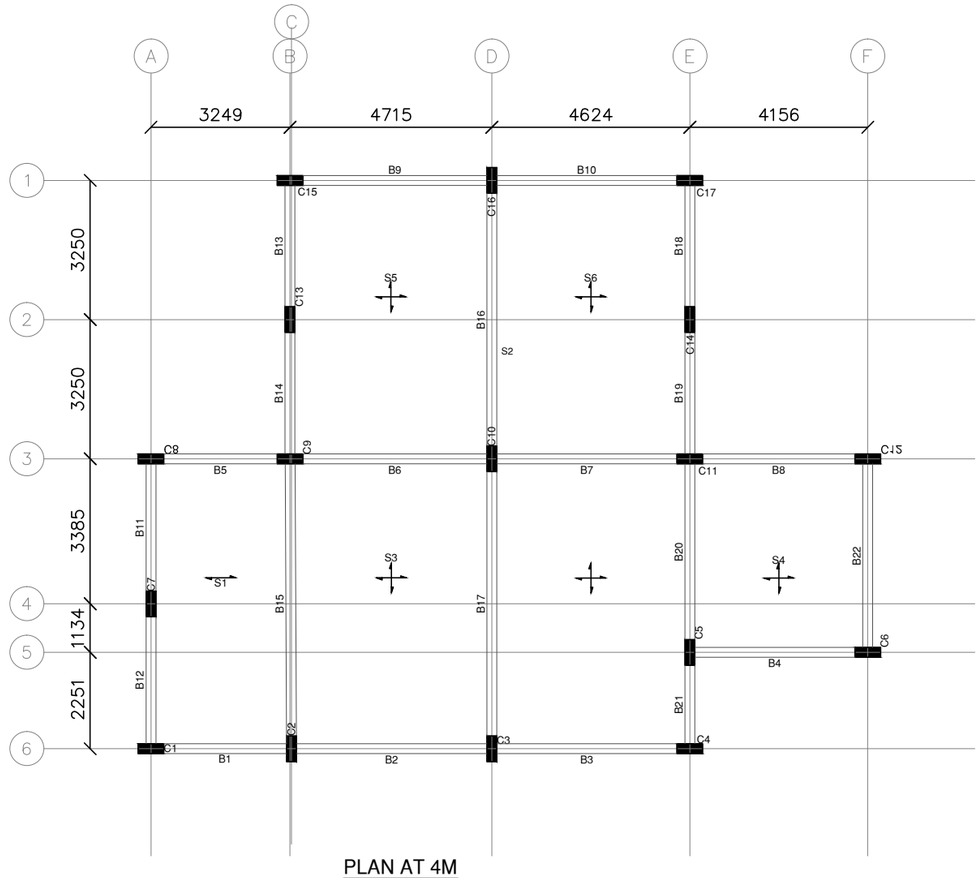
DWG NO. TCE.10753A–CV–3001–RC–40107

ISSUE P0

SIZE–A3

FILE NAME: F–093–Rev–R0.DWG

TCE FORM NO. 093 R0



PLAN AT 4M

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETRES AND LEVELS ARE IN METERS UNLESS OTHERWISE NOTED.
2. UNLESS MENTIONED OTHERWISE CEMENT SHALL BE ORDINARY PORTLAND CEMENT GARDE OF 43 CONFIRMING TO IS:269
3. STRUCTURAL CONCRETE SHALL BE OF M25 GRADE WITH 20MM DOWNGRADED COARSE SIZE UNLESS NOTED.
4. BACK FILLING SHALL BE DONE IN UNIFORM LAYERS OF 150mm AND EVENLY ALL ROUND THE STRUCTURE.
5. IF ANY BLACK COTTON SOIL ENCOUNTERED SAME SHALL BE REPLACED BY WELL COMPACTED SOIL, SHALL BE COMPACTED TO 95% MODIFIED PROCTOR DENSITY
6. AS PER SOIL INVESTIGATION REPORT NET ALLOWABLE SAFE BEARING CAPACITY OF SOIL CONSIDERED IS 200kN/SQ.M AND SAME TO BE CONFIRMED AT SITE
7. CLEAR COVER TO MAIN REINFORCEMENT SHALL BE AS FOLLOWS.
   - COLUMNS --- 40 MM ALL SIDES.
   - FOOTING --- 50 MM ALL SIDES.
   - WALL --- 40 MM ALL SIDES.
   - BEAM --- 30 MM ALL SIDES.
   - SLAB --- 20 MM ALL SIDES.
8. CLEAR SPACING OF BARS IN DIFFERENT LAYERS SHALL BE EQUAL TO THE MAXIMUM SIZE OF COARSE AGGREGATE.
9. SPLICING LENGTH SHALL BE 50 TIMES THE SMALLER DIAMETER OF THE BAR.
10. DEVELOPMENT LENGTH SHALL BE 50 TIMES THE DIAMETER OF BAR.

SLAB SCHEDULE (M25 : Fe415)(Level : 4m)

SLAB MARKED	SLAB THICKNESS	BOTTOM REINFORCEMENT				TOP REINFORCEMENT				DISTRIBUTION
		ALONG SHORT SPAN		ALONG LONG SPAN		OVER LONG SUPPORT		OVER SHORT SUPPORT		
		FULL LENGTH	CURTAILED	FULL LENGTH	CURTAILED	CONTINUOUS SUPPORT	END SUPPORT	CONTINUOUS SUPPORT	END SUPPORT	
S1	150	T8 @ 175	---	T8 @ 300	---	T8 @ 130	---	---	T8 @ 300	T8 @ 300
S2	150	T8 @ 135	---	T8 @ 195	---	T8 @ 100	---	T8 @ 145	T8 @ 300	T8 @ 300
S3	150	T8 @ 130	---	T8 @ 190	---	T10 @ 150	---	T8 @ 140	T8 @ 300	T8 @ 300
S4	150	T8 @ 150	---	T8 @ 150	---	T8 @ 110	T8 @ 300	---	T8 @ 300	T8 @ 300
S5	150	T10 @ 260	T10 @ 260	T8 @ 120	---	T10 @ 115	T8 @ 300	T8 @ 110	T8 @ 300	T8 @ 300
S6	150	T10 @ 280	T10 @ 280	T8 @ 130	---	T10 @ 115	T8 @ 300	T8 @ 115	T8 @ 300	T8 @ 300

	SIGN.												
	INITIALS												
	REVISIONS												
P0	SIGN.												10.1.17
	INITIALS	LSD	MBC	UN									
	REVISIONS												
SSUE		DRN	DSN	CHD	CV	EL	IC	ME			PE/PM	APPD	DATE
		CLEARED											

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FOR APPROVAL

DO NOT SCALE

FILE NAME:TCE.10753A-CV-40108-10109.DWG

HUBBALI-DHARWAD SMART CITY LTD

ROOF SLABS LAYOUT OF ELECTRIC CREMATORIUM

TATA CONSULTING ENGINEERS LIMITED

IN ASSOCIATION WITH

PRICEWATERHOUSECOOPERS PRIVATE LIMITED

SCALE : NTS

DC & DISC: BLR & CV

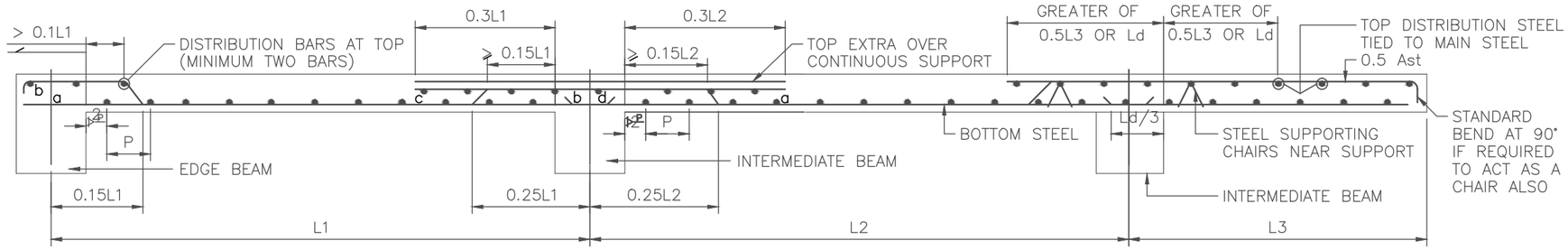
DWG NO. TCE.10753A-CV-3001-RC-40108

ISSUE P0

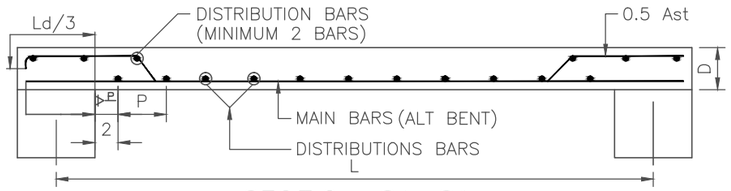
SIZE-A3

FILE NAME: F-093-Rev-R0.DWG

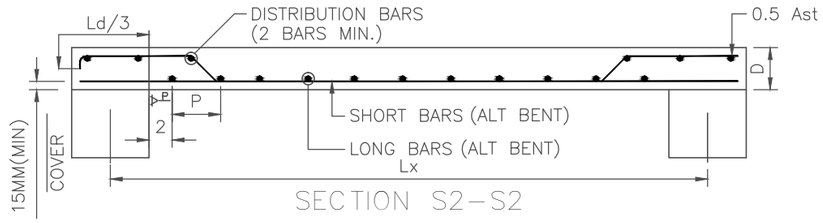
TCE FORM NO. 093 R0



TYP SECTIONAL ELEVATION OF SLAB



SECTION S1–S1



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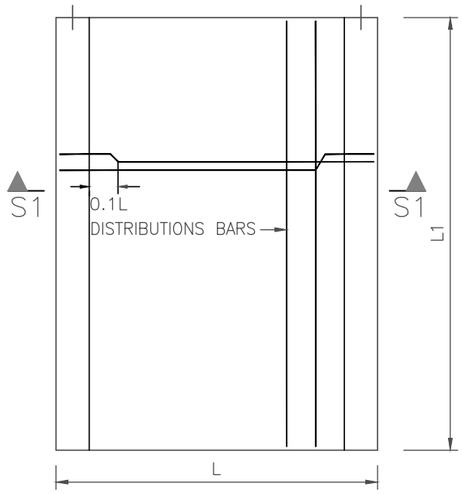
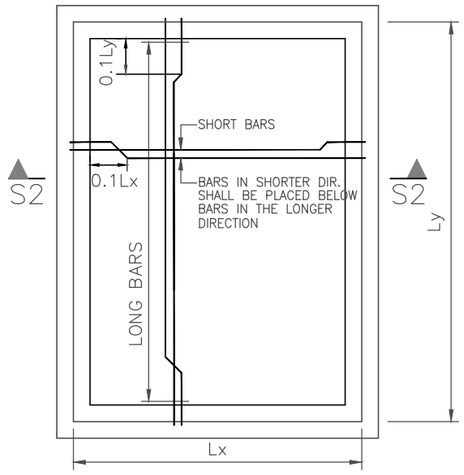


PLAN OF ONE WAY SALB



PLAN OF TWO WAY SALB

	SIGN.													
	INITIALS													
	REVISIONS													
	SIGN.													
P0	INITIALS	LSD	MBC	UN										10.11.17
	REVISIONS													
ISSUE		DRN	DSN	CHD	CV	EL	IC	ME			PE/PM	APPD	DATE	
					CLEARED									

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FOR APPROVAL

DO NOT SCALE

FILE NAME: TCE.10753A-CV-40108-10109.DWG

HUBBALI–DHARWAD SMART CITY LTD

TYPICAL REINFORCEMENT DETAILS FOR ROOF SLABS OF ELECTRIC CREMATORIUM

TATA CONSULTING ENGINEERS LIMITED

IN ASSOCIATION WITH

PRICEWATERHOUSECOOPERS PRIVATE LIMITED

SCALE : NTS

DC & DISC: BLR & CV

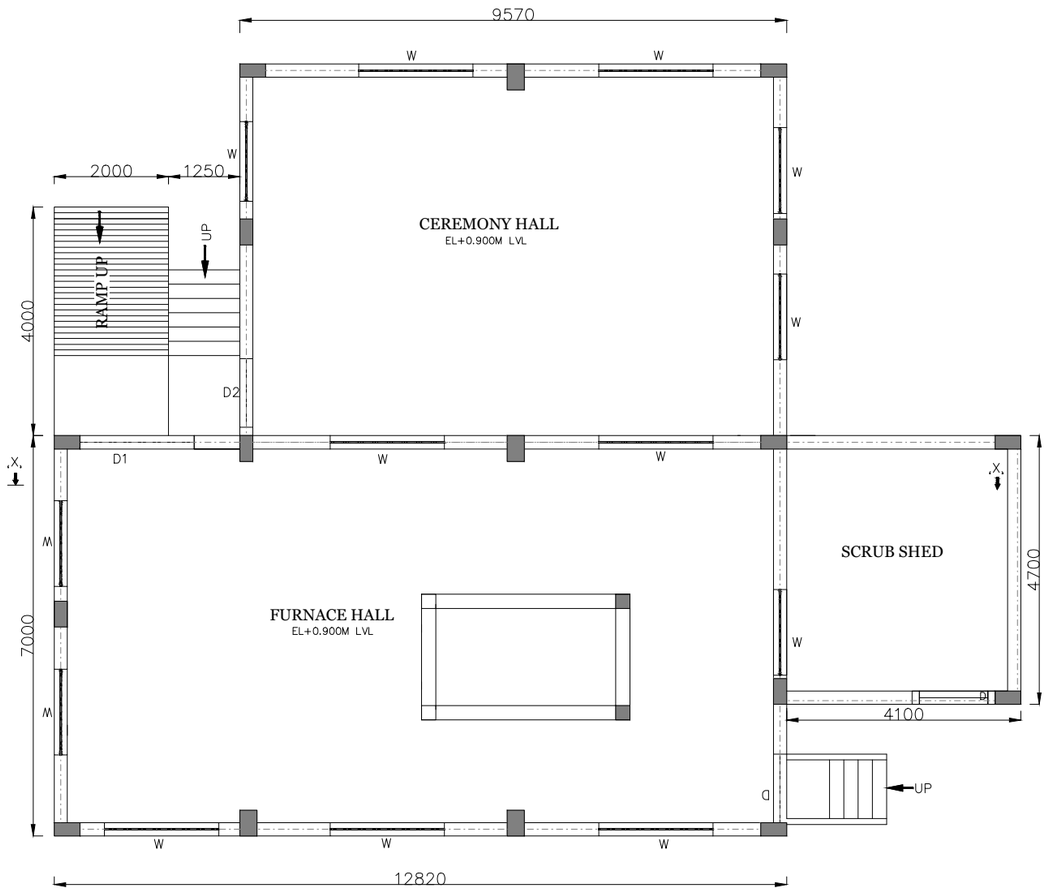
DWG NO. TCE.10753A-CV-3001-RC-40109

ISSUE P0

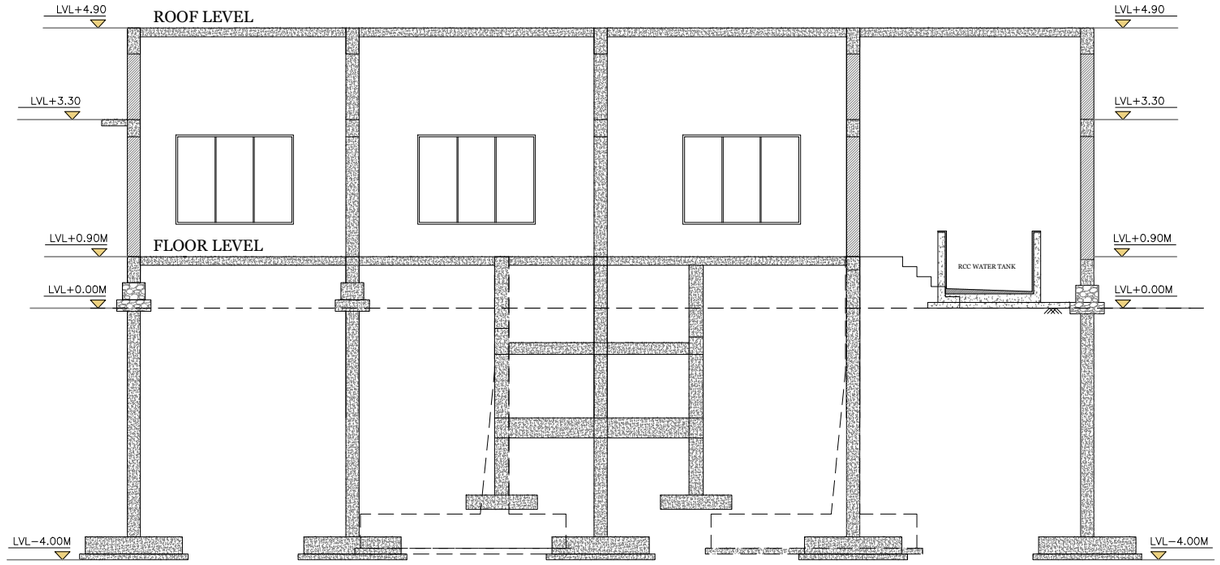
SIZE-A3

FILE NAME: F-093-Rev-R0.DWG

TCE FORM NO. 093 R0



PLAN



VIEW FROM 'X'-'X'

	SIGN.												
	INITIALS												
	REVISIONS												
P0	SIGN.												
	INITIALS	LSD	MBC	UN									06.1.17
	REVISIONS												
ISSUE		DRN	DSN	CHD	CV	EL	IC	ME			PE/PM	APPD	DATE
					CLEARED								

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FOR APPROVAL

DO NOT SCALE

FILE NAME: TCE.10753A-CV-40110.DWG

HUBBALI-DHARWAD SMART CITY LTD

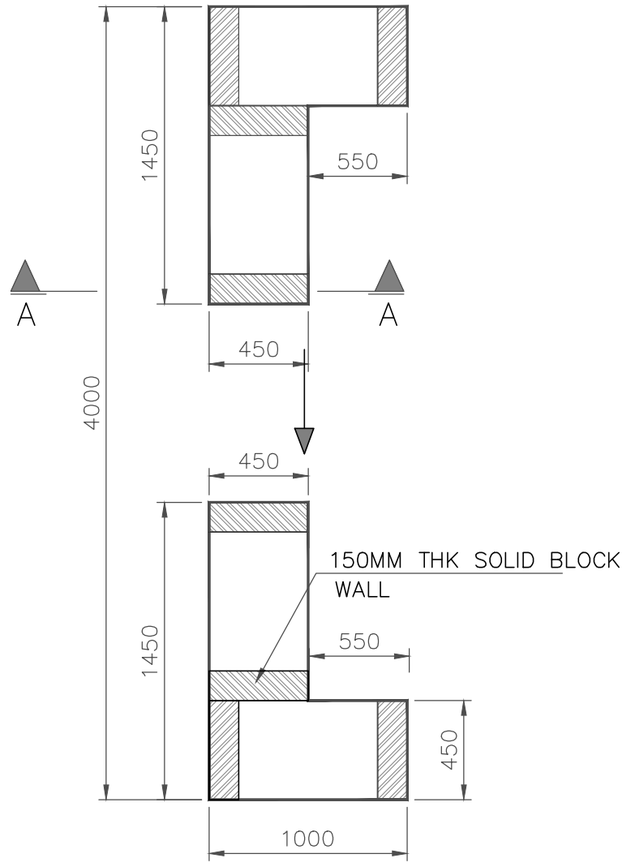
PLAN AND ELEVATION FOR ELECTRIC CREMATORIUM

TATA CONSULTING ENGINEERS LIMITED

IN ASSOCIATION WITH

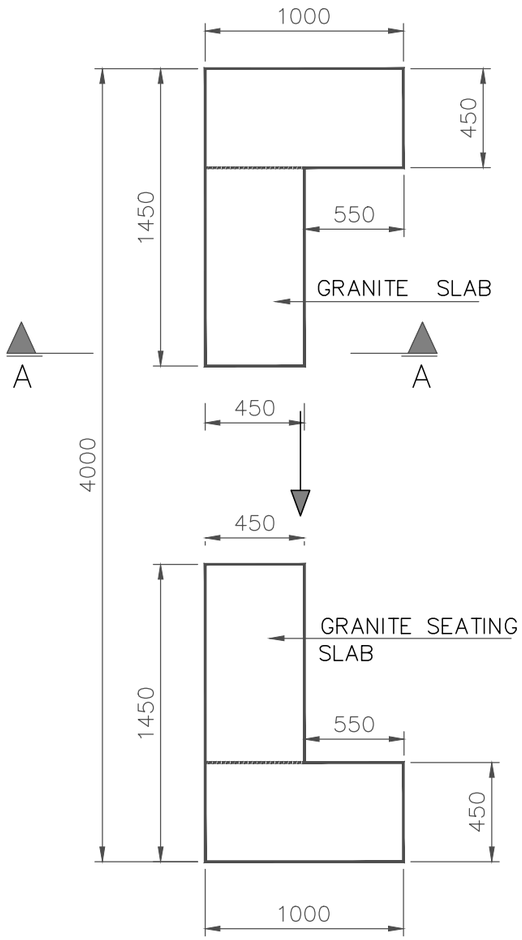
PRICEWATERHOUSE COOPERS PRIVATE LIMITED

SCALE	DWG NO.	ISSUE
: NTS	TCE.10753A-CV-3001-RC-40110	P0
DC & DISC: BLR & EL		



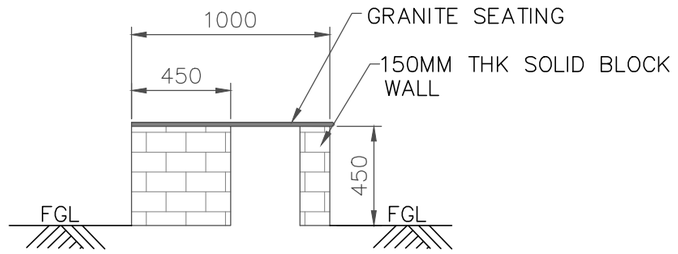
PLAN @ GROUND LEVEL

(SCALE 1:30)



PLAN @ SEATING LEVEL

(SCALE 1:30)



SECTION A - A

(SCALE 1:30)

	SIGN.												
	INITIALS												
	REVISIONS												
P0	SIGN.												
	INITIALS	LSD	MBC	UN									10.1'.'7
	REVISIONS												
SSUE		DRN	DSN	CHD	CV	EL	IC	ME			PE/PM	APPD	DATE
					CLEARED								

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FOR APPROVAL

DO NOT SCALE

FILE NAME: TCE.10753A-CV-4011.DWG

HUBBALI-DHARWAD SMART CITY LTD

GENARAL ARRANGEMENT DRAWING FOR SEATING ARRANGEMENT

TATA CONSULTING ENGINEERS LIMITED

IN ASSOCIATION WITH

PRICEWATERHOUSECOOPERS PRIVATE LIMITED

SCALE : AS SHOWN

DC & DISC: BLR & CV

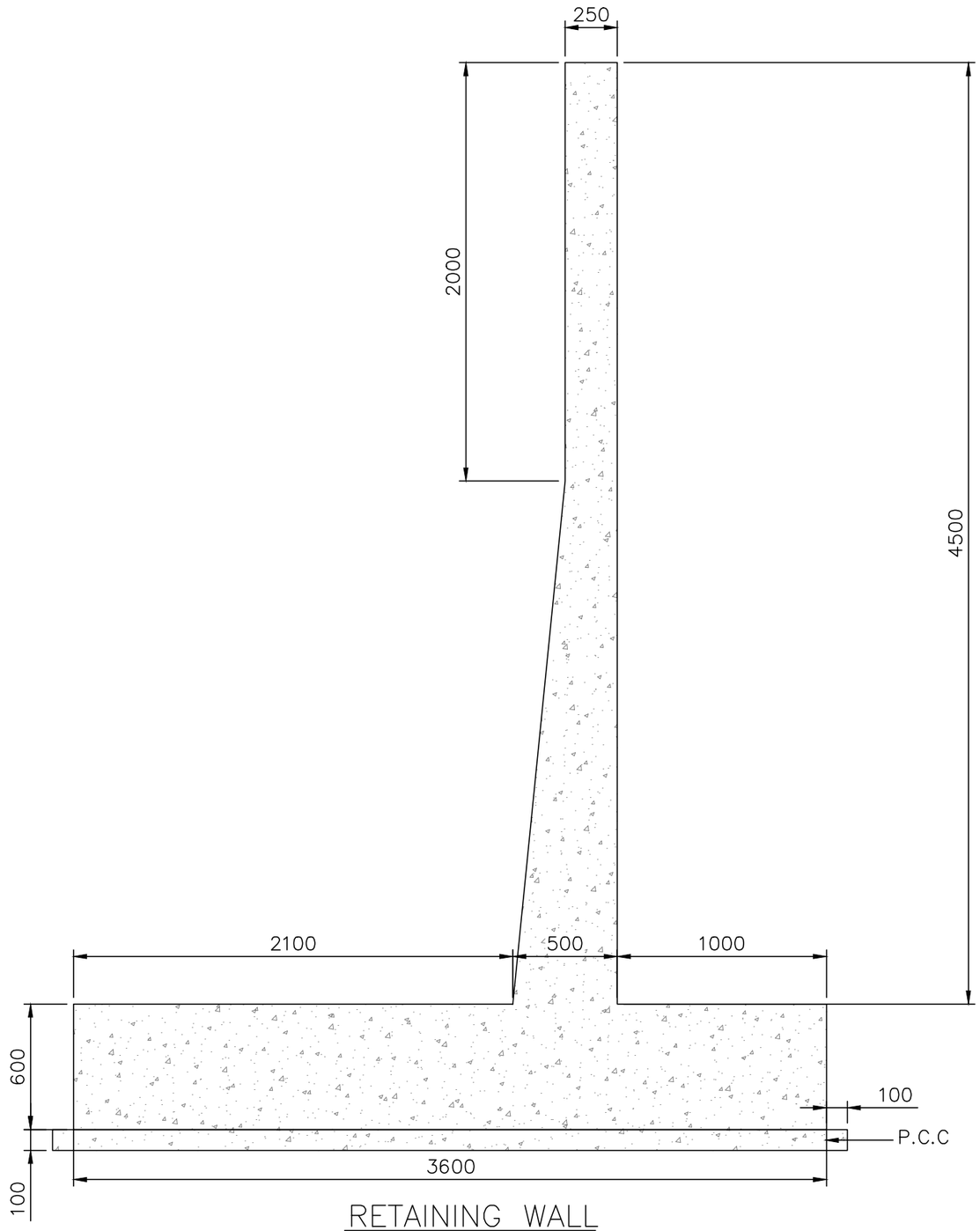
DWG NO. TCE.10753A-CV-3001-RC-40111

ISSUE P0

SIZE-A3

FILE NAME: F-093-Rev-R0.DWG

TCE FORM NO. 093 R0



RETAINING WALL

(SCALE 1:25)

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETRES AND LEVELS ARE IN METERS UNLESS OTHERWISE NOTED.
2. UNLESS MENTIONED OTHERWISE CEMENT SHALL BE ORDINARY PORTLAND CEMENT GARDE OF 43 CONFIRMING TO IS:269
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4. BACK FILLING SHALL BE DONE IN UNIFORM LAYERS OF 150mm AND EVENLY ALL ROUND THE STRUCTURE.
5. IF ANY BLACK COTTON SOIL ENCOUNTERED SAME SHALL BE REPLACED BY WELL COMPACTED SOIL, SHALL BE COMPACTED TO 95% MODIFIED PROCTOR DENSITY
6. AS PER SOIL INVESTIGATION REPORT NET ALLOWABLE SAFE BEARING CAPACITY OF SOIL CONSIDERED IS 200kN/SQ.M AND SAME TO BE CONFIRMED AT SITE
7. CLEAR SPACING OF BARS IN DIFFERENT LAYERS SHALL BE EQUAL TO THE MAXIMUM SIZE OF COARSE AGGREGATE.
8. SPLICING LENGTH SHALL BE 50 TIMES THE SMALLER DIAMETER OF THE BAR.
9. DEVELOPMENT LENGTH SHALL BE 50 TIMES THE DIAMETER OF BAR.

	SIGN.													
	INITIALS													
	REVISIONS													
P0	SIGN.													10.11.17
	INITIALS	LSD	MBC	UN										
	REVISIONS													
ISSUE		DRN	DSN	CHD	CV	EL	IC	ME			PE/PM	APPD	DATE	
					CLEARED									

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FOR APPROVAL

DO NOT SCALE

FILE NAME: TCE.10753A-CV-40112.DWG

HUBBALI-DHARWAD SMART CITY LTD

RETAINING WALL FOR ELECTRIC CREMATORIUM

TATA CONSULTING ENGINEERS LIMITED

IN ASSOCIATION WITH

PRICEWATERHOUSECOOPERS PRIVATE LIMITED

SCALE : AS SHOWN

DC & DISC: BLR & CV

DWG NO. TCE.10753A-CV-3001-RC-40110

ISSUE P0

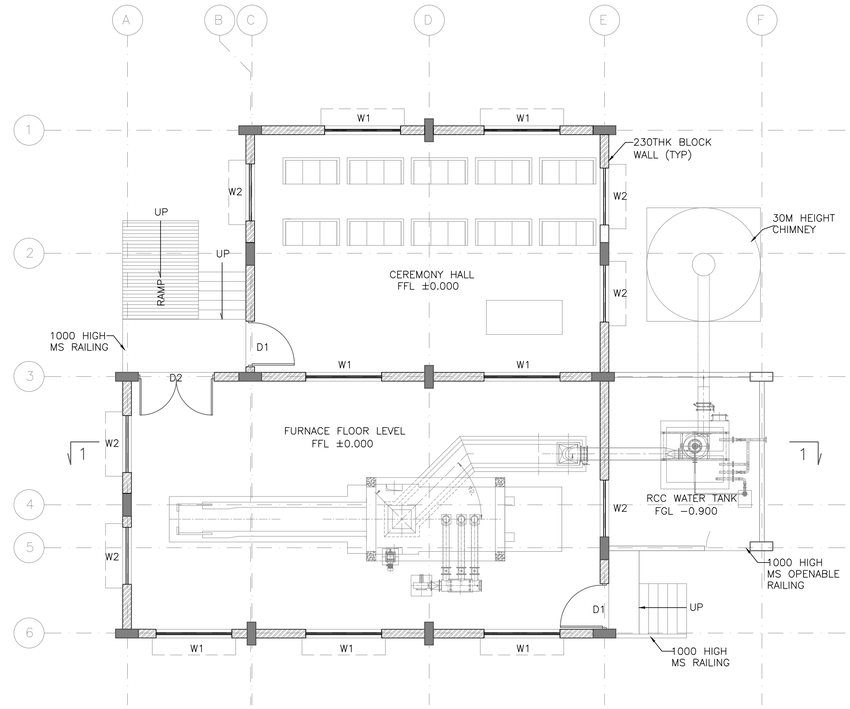
SIZE-A3

FILE NAME: F-093-Rev-R0.DWG

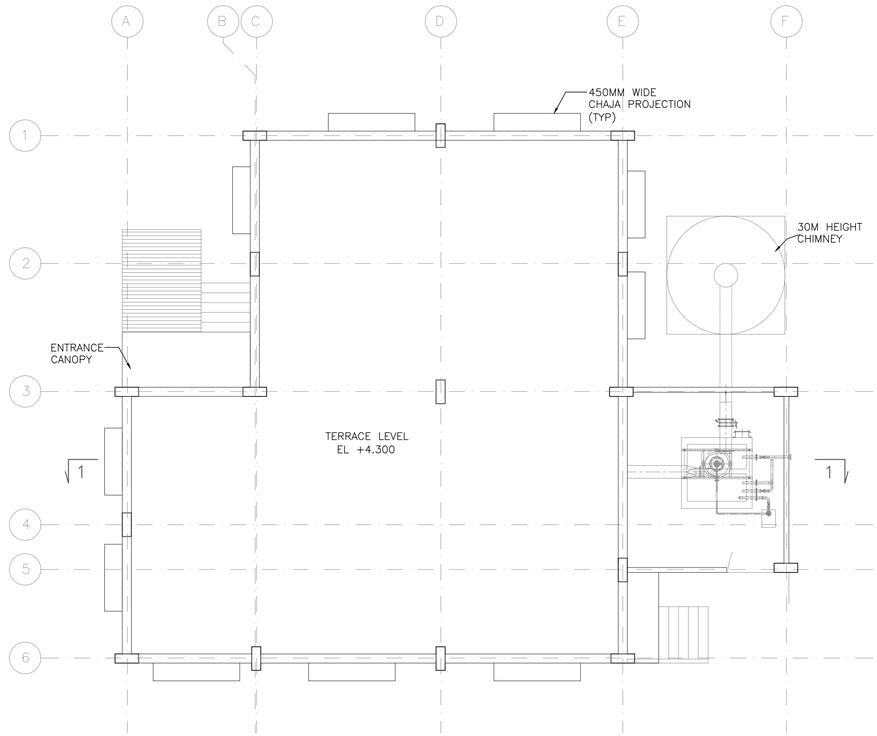
TCE FORM NO. 093 R0

TITLE: GROUND FLOOR PLAN,SECTION & ELEVATIONS OF ELECTRIC CREMATORIUM

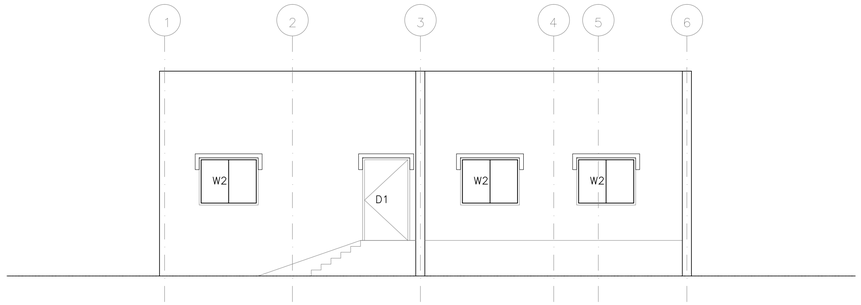
DWG NO TCE.10753A-AC-1022-AC-10050



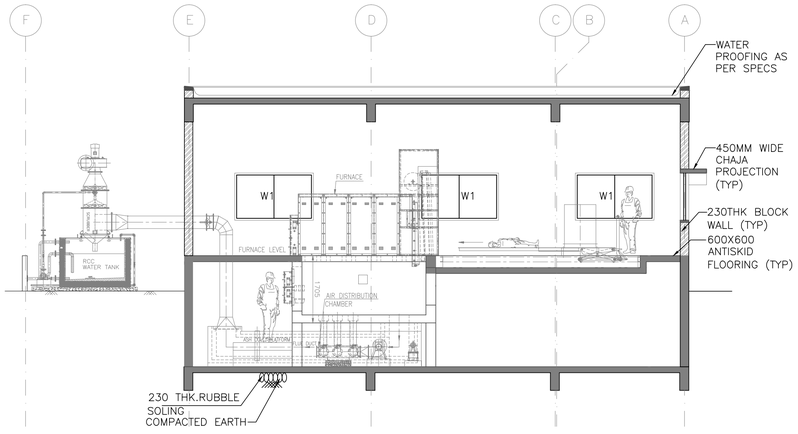
GROUND FLOOR PLAN
1:75



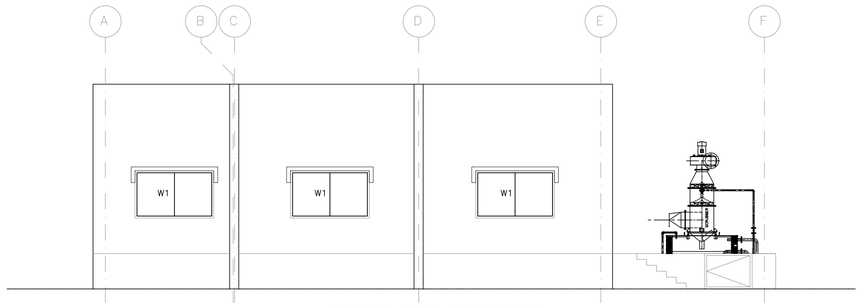
ROOF PLAN
1:75



EAST SIDE ELEVATION
1:75



SECTION 1−1
1:75



SOUTH SIDE ELEVATION
1:75

LEGEND

GL ---- GROUND LEVEL
FGL ---- FORMED / FINISHED GROUND LEVEL
EL ---- ELEVATION
FFL ---- FINISHED FLOOR LEVEL
FRL ---- FINISHED ROAD LEVEL
TYP. ---- TYPICAL
PCC ---- PLAIN CEMENT CONCRETE
THK. ---- THICK / THICKNESS
RCC ---- REINFORCED CEMENT CONCRETE
LT ---- LADIES TOILET
GT ---- GENTS TOILET

---- RCC
---- PCC
---- BLOCK MASONRY
---- MASONRY WALL 2.10M HIGH
RWP ---- RAINWATER PIPE

SPECS ---- SPECIFICATIONS
---- TILE DROP

NOTES

1. ALL DIMENSIONS ARE IN MILLIMETERS AND LEVELS & CO−ORDINATES ARE IN METERS UNLESS NOTED OTHERWISE.
2. IF IN DOUBT ASK, DO NOT SCALE THE DRAWING.

BRIEF SPECIFICATIONS

1. FOUNDATION UPTO HARD STRATA
2. PLAIN CEMENT CONCRETE PLINTH PROTECTION ALL AROUND THE BUILDING WILL BE PROVIDED.
3. 200MM THICK SOLID CONCRETE BLOCK WALLS ON EXTERNAL & INTERNAL SIDE .
4. BLOCK MASONRY WORK WALLS TO HAVE VERTICAL & HORIZONTAL CONCRETE BANDS.
5. SAND FACED CEMENT PLASTER FOR EXTERNAL FACE AND SMOOTH FINISH CEMENT PLASTER FOR INTERNAL FACE.
6. KOTAH STONE FOR STEPS & ANTISKID TILES FLOORING
7. OIL BOUND DISTEMPER, WASHABLE ACRYCLIC EMULSION PAINT FOR INTERNAL WALLS AND CEMENT PAINT FOR EXTERNAL FACE.
8. ALUMINUM POWDER COATED WINDOWS WITH GLASS .

DOOR		
TYPE	SIZE W X H	SPECIFICATION
D1	1200X2100	FLUSH DOOR
D2	2000X2100	FLUSH DOUBLE DOOR

WINDOW		
TYPE	SIZE W X H	SPECIFICATION
W1	2000X1200	POWDER COATED ALUMINUM SLIDING WINDOW
W2	1500X1200	POWDER COATED ALUMINUM SLIDING WINDOW

	SIGN.												
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	REVISIONS												
	SIGN.												
	INITIALS												
	REVISIONS												
P0	SIGN.												10−11−2017
	INITIALS												
ISSUE		DRN	DSN	CHD	CV	EL	IC	ME	CLEARED		PE/PM	APPD	DATE

FOR APPROVAL

DO NOT SCALE

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FILE NAME : TCE.10753A−AC−10050

HUBBALI−DHARWAD SMART CITY LTD

GROUND FLOOR PLAN,SECTION & ELEVATIONS OF ELECTRIC CREMATORIUM

TATA CONSULTING ENGINEERS LIMITED
IN ASSOCIATION WITH
PRICE WATER COOPERS PRIVATE LIMITED

SCALE : AS SHOWN
DC & DISC : BLR & CV
DWG NO. TCE.10753A−AC−1022−AC−10050
ISSUE P0
SIZE-A1

FILE NAME: F−091−Rev−R0.dwg
TCE FORM NO. 091 R0

DWG NO: TCE.10753A-AC-1000-AC-10051

TITLE: SITE PLAN OF ELECTRIC CREMATORIUM

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	INITIALS											10-11-2017
ISSUE		DRN	DSN	CHD	CV	EL	IC	ME			PE/PM	APPD	DATE
					CLEARED								

FOR APPROVAL

DO NOT SCALE

'P' (PRELIMINARY) ISSUES ARE NOT TO BE USED FOR CONSTRUCTION / FABRICATION BUT ARE ISSUED FOR LIMITED PURPOSES ONLY AS INDICATED IN THE SMALL BLOCK ABOVE THIS BLOCK.

CONSTRUCTION / FABRICATION WORK IS PERMITTED ON 'R' (RELEASED) ISSUES ONLY.

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FILE NAME : TCE.10753A-AC-10051

HUBBALI-DHARWAD SMART CITY LTD

SITE PLAN OF
ELECTRIC CREMATORIUM

TATA CONSULTING ENGINEERS LIMITED
IN ASSOCIATION WITH
PRICE WATER COOPERS PRIVATE LIMITED

SCALE : AS SHOWN
DC & DISC: BLR & CV

DWG NO. TCE.10753A-AC-1000-AC-10051

ISSUE P0

SIZE-A2

FILE NAME: F-092-Rev-R0.dwg

TCE FORM NO. 092 R0

NORTH

Lawn
Seater
Paved Plaza
3 m wide road
Seater
Palms in Gravel Bed
Lawn
Shrub beds
1.5 m Interlocking pathway
Lawn
Michelia champaca
Lawn
Toilet block under construction
Approach road 4.5 m wide
Proposed water point
UP
RAMP
CEREMONY HALL FFL ±0.000
FURNACE FLOOR LEVEL FFL ±0.000
RCC WATER TANK FGL −0.900
1.5 m paved pathway
Seaters
Paved Area
Lawn
Hardscape
Seater
Aromatic shrub bed
Aromatic trees

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	SIGN.	INITIALS	REVISIONS

ISSUE	DRN	DSN	CHD	CV	EL	IC	ME	PE/PM	APPD	DATE
				CLEARED						10-11-2017

HUBBALI–DHARWAD SMART CITY LTD

LOCATION PLAN OF ELECTRIC CREMATORIUM

TATA CONSULTING ENGINEERS LIMITED
IN ASSOCIATION WITH
PRICE WATER COOPERS PRIVATE LIMITED

SCALE : AS SHOWN	DWG. NO.	ISSUE
DC & DISC: BLR & CV	TCE.10753A–AC–1000–AC–10052	

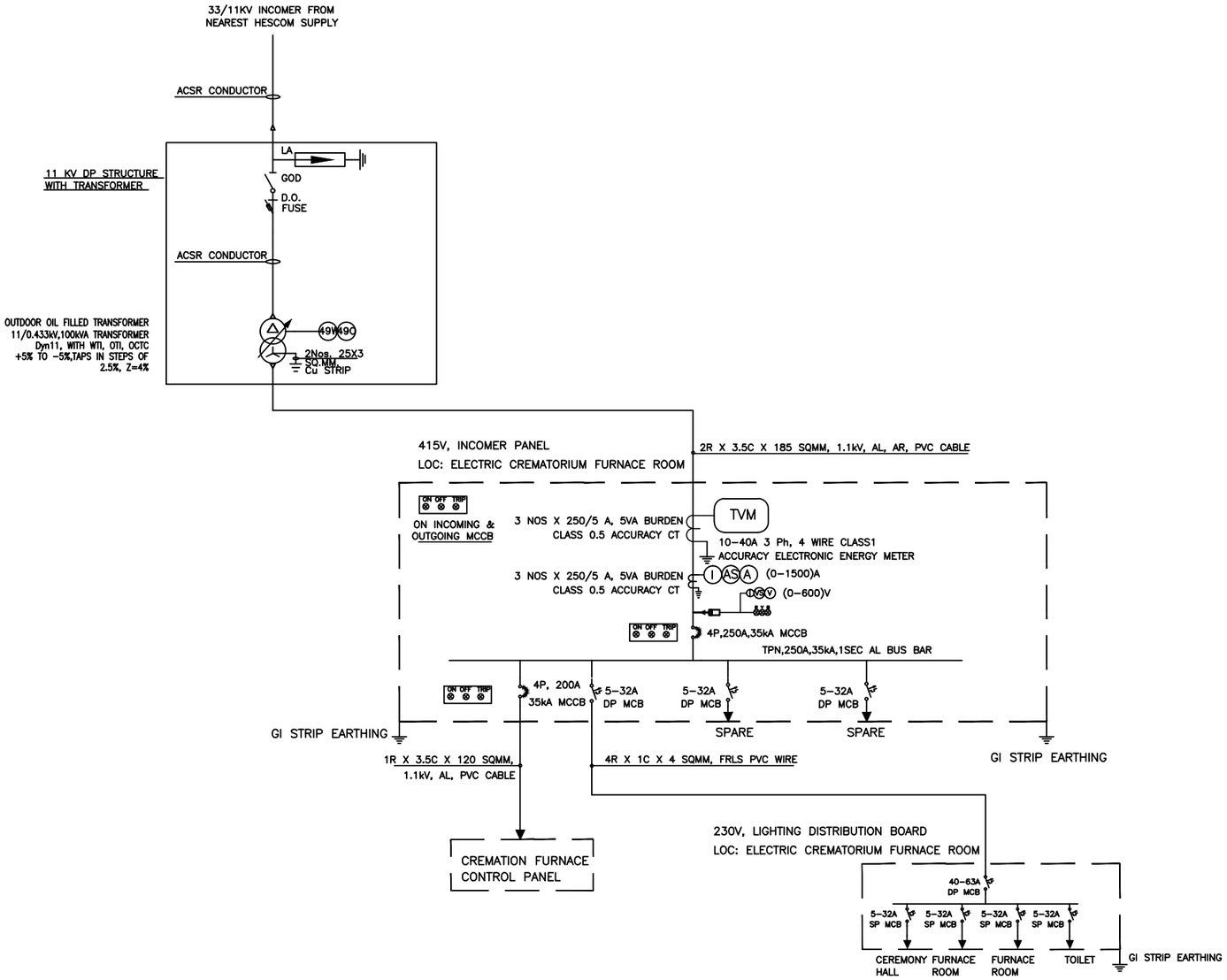
FILE NAME : TCE.10753A–AC–10052.DWG

TITLE: LOCATION PLAN OF ELECTRIC CREMATORIUM

DWG NO TCE.10753A–AC–1000–AC–10052

FILE NAME: F:\090-Rev-R0.dwg

TCE FORM NO. 090 R0



LEGENDS

- THREE PHASE TRANSFORMER WITH OCTC
- MCCB
- MCB
- CURRENT TRANSFORMER (FIGURE INDICATES NO. OF CTs)
- LIGHTNING ARRESTOR
- ON,OFF,TRIP INDICATION LAMP
- PHASE INDICATION LAMP
- ANALOG AMMETER
- ANALOG VOLTMETER
- AMMETER SELECTOR SWITCH
- VOLTMETER SELECTOR SWITCH
- D.O FUSE.
- ISOLATOR / GOD
- TVM — TRIVECTOR METER (TARIFF METER AS PER GEB REQ.) TRIVECTOR METER

NOTES:

1. RATINGS & SIZES OF EQUIPMENTS (WHEREVER GIVEN) ARE MINIMUM REQUIREMENTS AND ARE FOR REFERENCE ONLY.BIDDER SHALL CALCULATE EQUIPMENT SIZES & RATINGS BASED ON DESIGN CRITERIA GIVEN IN TENDER.
2. FOLLOWING INDICATIONS SHALL BE PROVIDED FOR EACH BREAKER ON,OFF,AUTO TRIP, SPRING CHARGED.TRIP CIRCUIT HEALTHY,TEST POSITION, SERVICE POSITION,CONTROL SUPPLY HEALTHY.
3. R,Y,B PHASE INDICATION SHALL BE PROVIDED FOR EACH BREAKER PANEL.
4. ALL PROTECTION RELAYS ARE NUMERICAL TYPE AND PC COMPATIABLE SHALL BE SUITABLE FOR SCADA CONNECTIVITY WITH RS485 MODBUS & RJ45 PORT.
5. ALL MICROPROCESSOR BASED EQUIPMENT/SWGR & METERING SHALL BE SUITABLE FOR SCADA CONNECTIVITY WITH RS485 MODBUS & RJ45 PORT.
6. INTERLOCKING SHALL BE PROVIDED FOR TRANSFORMER FEEDER SUCH THAT WHEN PRIMARY SIDE BREAKER TRIPS.SECONDARY SIDE BREAKER SHALL BE TRIPPED AND IT SHALL NOT BE POSSIBLE TO CLOSE SECONDARY SIDE BREAKERUNLESS PRIMARY SIDE BREAKER IS CLOSED.
7. AUXILIARY CT REQUIREMENT IF ANY WILL BE IN CONTRACTORS SCOPE.
8. BACKUP CALCULATION SHALL BE SUBMITTED FOR CLIENT/CONSULTANT'S REVIEW.
9. THIS SLD IS INDICATIVE AND FOR REFERENCE PURPOSE ONLY.
10. LIST OF EQUIPMENT & kW RATING IS TENTATIVE SHALL BE FINALISED DURING DETAIL ENGINEERING AS PER PROCESS REQUIREMENT.

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	REVISIONS												
ISSUE		DRN	DSN	CHD	CV	EL	IC	ME			PE/PM	APPD	DATE
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FOR APPROVAL

DO NOT SCALE

FILE NAME: 10753A-EL-40100.DWG

HUBBALI-DHARWAD SMART CITY LTD

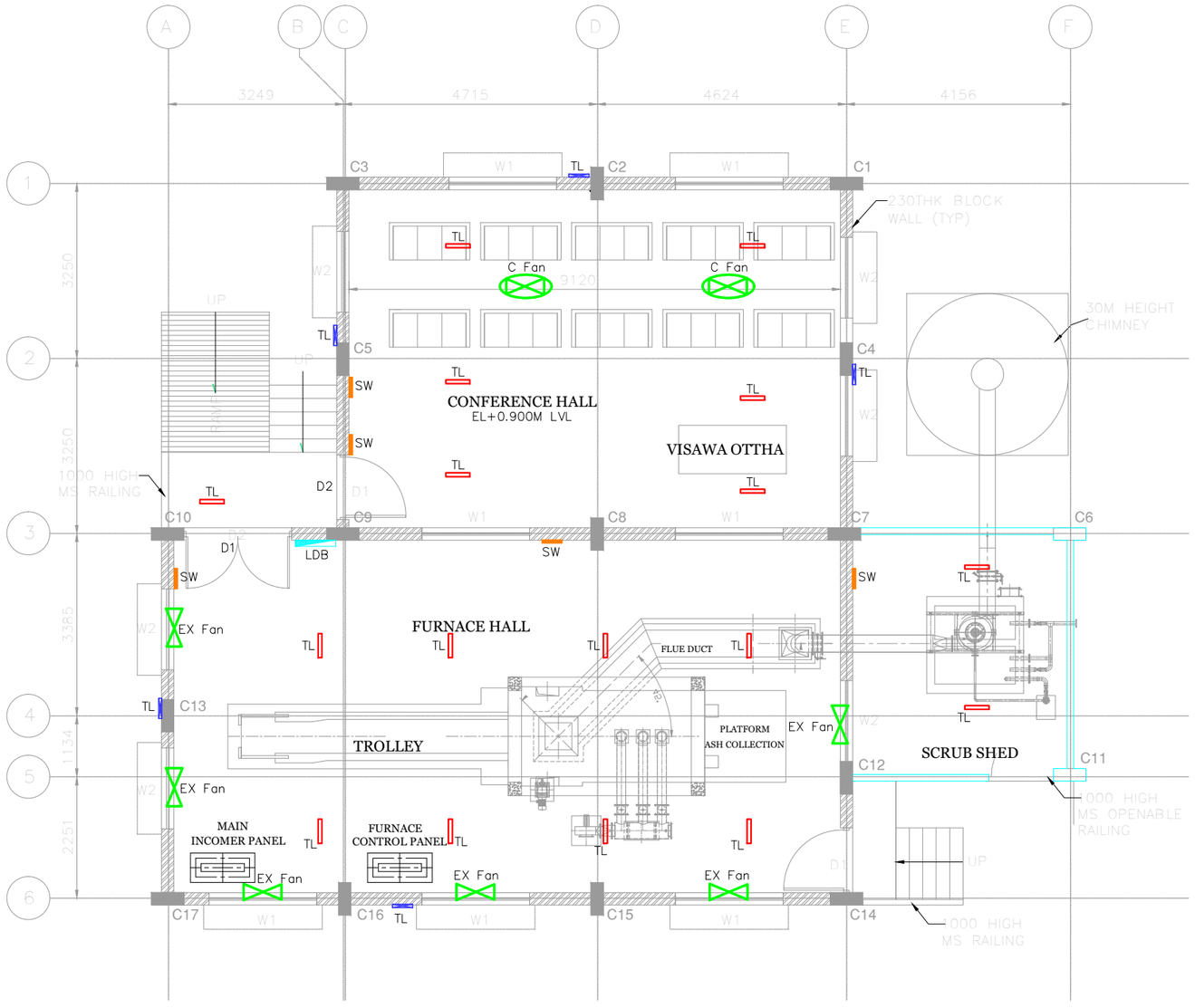
SINGLE LINE DIAGRAM OF
ELECTRIC CREMATORIUM

TATA CONSULTING ENGINEERS LIMITED

IN ASSOCIATION WITH

PRICEWATERHOUSECOOPERS PRIVATE LIMITED

SCALE	DWG NO.	ISSUE
: NTS	TCE.10753A-EL-4032-AU-40100	P0
DC & DISC: BLR & EL		



GROUND FLOOR PLAN

1:75

SYMBOLS	DESCRIPTION	QTY
	2X4'–28W T5 Single/Twin lamp along with stove enameled white reflector and suspension mounted luminairee & optical reflector	15
	4'–28walt patty type fluorescent tubelight fitting made out of MS sheet and stive enameled with HF electronics Ballast	5
	Ceiling Fan	2
	Exhaust Fan	6
	Lighting Board	1
	Switch Board	5

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETRES.
2. THIS LIGHTING LAYOUT HAS BEEN PREPARED BASED ON LED FIXTURES AVAILABLE IN SOR.
3. LAYOUT SHOWN IN INDICATIVE AND MAY BE REQUIRED TO BE MODIFIED TO SIUT SITE CONDITIONS IN CONSULATION WITH SITE ENGINEER.
4. LIGHTING INSTALLATION SHALL BE CARRIED OUT ONLY AFTER ALL CIVIL WORK IN THE PARTICULAR AREA HAVE BEEN COMPLETED.
5. EARTHING FOR LIGHT FIXTURES SHALL BE PROVIDED AS PER EARTHING NOTES & DETAILS AND RELEVANT STANDARDS
6. BALLAST LOSS ARE CONSIDERED AS 20% OF LIGHT FIXTURE (WHERE EVER APPLICABLE) AND THE SAME WILL BE UPDATED BASED ON ACTUAL BALLAST LOSSES.
7. BACKUP CALCULATION SHALL BE SUBMITTED FOR CLIENT/CONSULTANT'S REVIEW.
8. THIS SLD IS INDICATIVE AND FOR REFERENCE PURPOSE ONLY.
9. ALL LIGHTING PANELS SHALL BE SUITABLE FOR WALL/COLUMN MOUNTING.
10. THE LIGHTING FIXTURE SHALL BE WIRED WITH PVC INSULATED 2.5sq.mm STRANDED COPPER WIRES WHEREAS RECEPTABLE SHALL BE WIRED WITH 4sqmm. COPPER WIRES UNLESS OTHERWISE NOTED.
11. ALL LIGHTING FIXTURES WILL BE EARTHED USING 12 SWG G.I. WIRE RUNNING ALONG THE ENTIRE LENGTH OF CONDUIT.ALL LIGHTING PANEL WILL BE EARTHED THROUGH 25x3mm GS FLAT.
12. WIRES OF DIFFERENT PHASES SHALL NOT RUN IN SAME CONDUCT.
13. LIGHTING PANELS SHALL BE INSTALLED AT THE FOLLOWING
    MOUNTING HEIGHTS FROM THE FINISHED FLOOR LEVEL
    LIGHTING PANEL – 1500mm FROM FFL
    SWITCHBOARD – 1500mm FROM FFL
    RECEPTACLES – 1500mm FROM FFL
14. LOAD (WATTAGE) IS EQUALLY DISTRIBUTED ON ALL THREE PHASES.
15. INSTALLATION WORK HAS TO BE DONE IN CLOSE COORDINATION WITH CIVIL CONTRACTOR.
16 THE BOD IS FOR INFORMATION ONLY AND THE QUANTITY SHALL BE PROVIDED AS PER THE SITE REQUIREMENT.

HUBBALI–DHARWAD SMART CITY LTD

LIGHTING LAYOUT OF
ELECTRIC CREMATORIUM

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	INITIALS													
	REVISIONS													
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ISSUE		DRN	DSN	CHD	CV	EL	IC	ME			PE/PM	APPD	DATE	
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TATA CONSULTING ENGINEERS LIMITED
IN ASSOCIATION WITH
PRICEWATERHOUSECOOPERS PRIVATE LIMITED

SCALE	NTS	DWG NO.	TCE.10753A–EL–4026–GL–40101	ISSUE	P0
DC & DISC	BLR & EL				

SIZE–A3

FILE NAME: F–093–Rev–R0.DWG

TCE FORM NO. 093 R0