REQUEST FOR PROPOSAL (RFP)

REQUEST FOR PROPOSAL FOR RAJPUR ROAD LANDSCAPING PROJECT UNDER "SMART CITY MISSION" THROUGH E-PROCUREMENT.

DEHRADUN SMART CITY LIMITED (DSCL)

777, Saatvik Tower, Rajender Nagar,
Kaulagarh Road, Dehradun, 248001, Uttarakhand, India
Ph: 0135-270894, Fax: 0135-2750817

RFP No: 01/DSCL/20-21/NCB/RRL

Issued on: 23/11/2020

DISCLAIMER

The information contained in this Request for Proposal (RFP) document or subsequently provided to Bidders, whether verbally or in documentary form by or on behalf of Dehradun Smart City Limited or any of its employees or Transaction advisors, is provided to Bidders on the terms and conditions set out in this RFP document and any other terms and conditions subject to which such information is provided.

This RFP document is not an Agreement and is not an offer or invitation to any other party. The purpose of this RFP document is to provide the Bidders with information to assist the formulation of their Bid submission. This RFP document does not purport to contain all the information each Bidder may require. This RFP document may not be appropriate for all persons and it is not possible for DSCL and their employees or Transaction advisors to consider the investment objectives, financial situation and particular needs of each Bidder. Certain Bidders may have a better knowledge of the proposed Project than others. Each recipient must conduct its own analysis of the information contained in this RFP document or to correct any inaccuracies therein that may appear in this RFP document and is advised to carry out its own investigation into the proposed Project, the legislative and regulatory regimes which applies thereto and by and all matters pertinent to the proposed Project and to seek its own professional advice on the legal, financial, regulatory and taxation consequences of entering into any agreement or arrangement relating to the proposed Project.

DSCL and their employees and Transaction advisors make no representation or warranty and shall incur no liability under the Law of Contract, Tort, the Principles of Restitution or unjust enrichment or otherwise for any loss, expense or damage, accuracy, reliability or completeness of the RFP document, which may arise from or be incurred or suffered in connection with anything contained in this RFP, any matter deemed to form part of this RFP document, the award of the Project, the information and any other information supplied by or on behalf DSCL or their employees, any consultants or otherwise arising in any way from the selection process for the Project.

DSCL may in its absolute discretion, but without being under any obligation to do so, can amend or supplement the information/clauses/articles in this RFP document. The information that DSCL is in a position to furnish is limited to this RFP only. The information contained in the RFP must be kept confidential. Mere submission of a responsive Bid/ Bid does not ensure selection of the Bidder as Contractor.

NOTICE INVITING TENDER-IMPORTANT DATES

Sl. No.	Activity	Duration
1.	Bid Ref No.	01/DSCL/20-21/NCB/RRL
2.	Availability of Bid Documents	The Bid documents for this work shall be available from website http://uktenders.gov.in **from 23/11/2020 at 1000 Hours to 14/12/2020 up to 1000 Hours.**
3.	Pre-Bid Meeting	**30/11/2020 at 1100 Hours.** Bidder shall have to email their queries to agmproc-dscl@uk.gov.in on or before the pre-bid meeting date. Venue of Pre Bid Conference – Dehradun Smart City Limited, 777, Saatvik Tower, Rajender Nagar, Kaulagarh Road, Dehradun, 248001, Uttarakhand, India, Ph: 0135-2750894, Fax: 0135-2750817
4.	Contact Person	**Mr. Surya Kotnala, Asst. General Manager (Procurement & Contract Management), Mob: +91 7060033338**
5.	Last date for downloading of Bid document from the E-procurement portal http://uktenders.gov.in	**14/12/2020 up to 1000 Hours**. The scan copy of the RFP document fees (Non-Refundable), Bid Security (EMD) and Affidavit shall be uploaded on the e-procurement website.
6.	Last date and time for Bid submission/ uploading of Bid in E-procurement	**14/12/2020 up to 1030 Hours**
7.	Submission of original documents i.e. RFP document fees (Non-Refundable), Bid Security (EMD) and Affidavit	**14/12/2020 up to 1100 Hours** Address for submission of original documents: Dehradun Smart City Limited, 777, Saatvik Tower, Rajender Nagar, Kaulagarh Road, Dehradun, 248001, Uttarakhand, India, Ph: 0135-2750894, Fax: 0135-2750817
8.	Time and date of opening of Technical Bids	The Technical Bids will be opened on line by the Authorized Officers on **14/12/2020 at 1130 Hours** in DSCL office.
9.	Date and time of opening of Financial Bids	Shall be informed later to technically qualified Bidders
10.	**Joint Venture/ Consortium**	**NOT ALLOWED**

NOTICE INVITING TENDER -IMPORTANT DATA

Bid Ref No.	01/DSCL/20-21/NCB/RRL	
Organization Name	Dehradun Smart City Limited (DSCL)	
Name of Work	Request for Proposal for Rajpur Road Landscaping Project under "Smart City Mission" through e-Procurement.	
Bid Type	National Competitive Bidding(NCB) Item Rate Mode	
Bid Currency	Indian National Rupees (INR) Only	
Payment Details	Bid validity period	90 days from the last date of Bid submission
	Project Duration	Implementation period –06 (Six) Months from the date of contract signing. Defect liability Period & Operation & Maintenance Period – 01 Years after the successful implementation period.
	RFP Document Fees **(Non-refundable)**	**INR 1180/- (Indian Rupees One Thousand One Hundred Eighty Only)** including GST in the form of Demand Draft drawn in favor of "Chief Executive Officer, Dehradun Smart City Limited, payable at Dehradun"
	Bid Security (EMD)	**INR 27,000/- (Indian Rupees Twenty Seven Thousand Only)** in the form of FDR/TDR payable at Dehradun or an unconditional Bank Guarantee issued in favor of "Chief Executive Officer, Dehradun Smart City Limited'.
	Bid Security (EMD) Validity	45 days beyond the date of validity of bids i.e. 90+45 days from the last date of submission of bid.
	Joint Venture/ Consortium	**NOT ALLOWED**
Addendum/Corrigendum	**Any Addendum/Corrigendum will be published on website http:// uktenders.gov.in only.**	

SECTION-I
INSTRUCTIONS TO BIDDERS

	General
1. Scope of Bid	1.1 The Employer as defined in the BDS invite bids for the Supply of Goods and Related Services as described in these documents and referred to as "the Works". The name and identification number of the Works and Related Services is provided in the BDS. The bidders may submit bid of the works detailed given in Scope of works section 2. 1.2 The successful Bidder will be expected to complete the Works by the Intended Completion Date specified in the Part I General Conditions of Contract. 1.3 Throughout these documents, (a) The terms "bid" and "tender" and their derivatives (bidder/ tenderer, bid/ tender, bidding/ tendering, etc.) are synonymous. (b) The term "in writing" means communicated in written form (e.g. by mail, e-mail, and fax, including if specified in the BDS, distributed or received through the electronic-procurement system used by the Employer) with proof of receipt; (c) if the context so requires, "singular" means "plural" and vice versa; and (d) "Day" means calendar day.
2. Source of Funds	2.1 The funds shall be made available by the Government of India & Government of Uttarakhand
3. Eligible Bidders	3.1 (a) A Bidder may be a firm that is a private or government entity (b) Joint Venture is not allowed. 3.2 A Bidder shall have the nationality of India. 3.3 Government of Uttarakhand considers a conflict of interest to be a situation in which a party has interests that could improperly influence that party's performance of official duties or responsibilities, contractual obligations, or compliance with applicable laws and regulations, and that such conflict of interest may contribute to or constitute a prohibited practice. DSCL will take appropriate actions, which include not financing the contract, if it determines that a conflict of interest has flawed the integrity of any procurement process. Consequently all Bidders found to have a conflict of interest shall be disqualified. A Bidder may be considered to be in a conflict of interest with one or more parties in this bidding process if, including but not limited to:

	(a) they have controlling shareholders in common; or (b) they receive or have received any direct or indirect subsidy from any of them; or (c) they have the same legal representative for purposes of this bid; or (d) they have a relationship with each other, directly or through common third parties, that puts them in a position to have access to information about or influence on the Bid of another Bidder, or (e) influence the decisions of the Employer regarding this bidding process; or (f) A Bidder participates in more than one bid in this bidding process. Participation by a Bidder in more than one Bid will result in the disqualification of all Bid in which the party is involved. However, this does not limit the inclusion of the same subcontractor, not otherwise participating as a Bidder, in more than one bid; or (g) A Bidder participated as a consultant in the preparation of the design or technical specifications of the contract that is the subject of the Bid; or (h) A Bidder was affiliated with a firm or entity that has been hired (or is proposed to be hired) by the Employer as Engineer for the contract. 3.4 A firm shall not be eligible to participate in any procurement activities under a Government-financed project while under sanction imposed by Uttarakhand Government/DSCL. A bid from a sanctioned firm will be rejected. 3.5 Government-owned enterprises shall be eligible only if they can establish that they are legally and financially autonomous and operate under commercial law, and that they are not a dependent agency of the Employer. 3.6 Bidders shall provide such evidence of their continued eligibility satisfactory to the Employer, as the Employer shall reasonably request. 3.7 In case a prequalification process has been conducted prior to the bidding process, this bidding is open only to pre-qualified Bidders..
	Bidding Documents
	Contents of Bidding Document
4. Sections of	4.1 The set of bidding documents comprises the documents listed

Bidding Document	below and should be read in conjunction with any addenda issued in accordance with Clause 6 of ITB. **PART 1** 1. Section I Instructions to Bidders (ITB) 2. Section II - Bid Data Sheet (BDS) 3. Section III - Evaluation and Qualification Criteria 4. Section IV - Bidding Forms 5. Section V – Scope of Work & Technical Specifications 6. Section VI General Conditions of Contract (GCC) 7. Section VII Particular Conditions of Contract (PCC) 8. Section VIII - Contract Forms **PART II** 1. Section IX Bill of Quantities (Price-Bid BOQ) 4.2 Bidding document will be available online on the website http://uktenders.gov.in. The bidder is expected to examine carefully all instructions, conditions of contract, Bid forms, terms and specifications, bill of quantities, Contract forms and drawings in the Bid Document. Failure to comply with the requirements of Bid Documents shall be at the bidder's own risk. Pursuant to clause 26.2 hereof, bids, which are not substantially responsive to the requirements of the Bid Documents, shall be rejected.
5. Clarification of Bidding Documents, Pre-bid Meeting & site visit	5.1 Prospective bidder requiring any clarification of the bidding document may notify the employer in writing by email on **agmproc-dscl@uk.gov.in**. The Employer will respond to any request for clarification received on or before the date of the pre-bid meeting. Copies of the employer's response will be uploaded in the e-procurement portal only including a description of the enquiry, but without identifying its source. 5.2 The Bidder is advised to visit and examine the Site of Works and its surroundings and obtain for itself, on its own risk and responsibility, all information that may be necessary for preparing the bid and entering into a contract for construction of the Works. The costs of visiting the Site shall be at the Bidder's own expense. 5.3 The Bidder and any of its personnel or agents will be granted permission by the Employer to enter upon its premises and lands for the purpose of such visit, but only upon the express condition that the Bidder, its personnel, and agents will release and indemnify the Employer and its personnel and agents from and against all liability in respect thereof, and will be responsible for death or personal injury, loss of or damage to property, and any other loss, damage, costs, and

	expenses incurred as a result of the inspection. 5.4 If a pre-bid meeting is to be held, the bidder or his authorized representative is invited to attend it. Its date, time and address are given in the notice inviting tender. The purpose of the meeting will be to clarify issues and to answer questions on any matter that may be raised at that stage. 5.5 The bidder is requested to submit any questions in writing on or before the pre bid meeting date in the format provided. 5.6 Minutes of the meeting, including the text of the questions raised (without identifying the source of the enquiry) and the responses given will be transmitted online (or otherwise). Any modifications of the bidding documents listed in Clause 4.1 of ITB, which may become necessary as a result of the pre-bid meeting shall be made by the Employer exclusively online through the issue of an Addendum pursuant to Clause 6 of ITB and not through the minutes of the pre-bid meeting. 5.7 Non-attendance at the pre-bid meeting will not be a cause for disqualification of a bidder.
6. Amendment of Bidding Documents	6.1 Before the deadline for submission of bids, the Employer may modify the bidding documents by issuing addenda online. 6.2 Any addendum thus issued shall be part of the bidding documents**.** 6.3 To give prospective bidders reasonable time in which to take an addendum into account in preparing their bids, the Employer shall extend, as necessary, the deadline for submission of bids, in accordance with Clause **20.2 of ITB.**
	Preparation of Bids
7. Language of Bids	7.1 All documents relating to the Bid shall be in the language specified in the BDS.

8. Documents Comprising the Bid	8.1 The Bid shall comprise two envelopes submitted simultaneously online on the e-Government Procurement System (e-GPS) in accordance with ITB 20.1. One called the Technical Bid containing the documents listed in ITB 8.2 and the other the Price Bid containing the documents listed in ITB 8.3. 8.2 The Technical Bid shall comprise the following: (a) Letter of Technical Bid; (b) Bid Security, in accordance with ITB 12; (c) written confirmation authorizing the signatory of the Bid to commit the Bidder, in accordance with ITB 13.1; (d) documentary evidence in accordance with ITB 18.1 establishing the Bidder's qualifications to perform the contract; (e) Technical Proposal in accordance with ITB 15.1; (f) Any other document required in the BDS. 8.3 The Price Bid shall comprise the following: (a) Letter of Price Bid; Completed Price Schedules, in accordance with ITB 9 and 10, or as stipulated in the BDS. (b) Any other document required in the BDS. 8.4 In addition to the requirements under ITB 8.2, bids submitted by a JV shall include a copy of the Joint Venture Agreement entered into by all partners. Alternatively, a Letter of Intent to execute a Joint Venture Agreement in the event of a successful bid shall be signed by all partners and submitted with the bid, together with a copy of the agreement.
9. Bid Prices	9.1 The Contract shall be for the whole Works, as described in Clause 1.1 of ITB, based on the priced Bill of Quantities submitted by the Bidder. 9.2 The Price bid made by the contractor should exclude the GST and all other taxes and duties. For GST, refer GCC clause 41.1. Therefore, all the duties, taxes, royalties and other levies payable by the Contractor under the Contract, or for any other cause, shall be excluded in the rates, prices, and total Bid price submitted by the Bidder. 9.3 The rates and prices quoted by the Bidder shall be fixed for the entire duration of the Contract and shall not be subjected to adjustment. 9.4 Provisional sum of 2 % of the awarded value of work shall be provided for the work of shifting of poles, cables, Telephone lines or other works approved by DSCL .The payment shall be paid to contractor on production of original bills and as per actual work done.

10. Currencies of Bid	10.1 The unit rates and the prices shall be quoted by the bidder entirely in Indian Rupees only.
11. Bid Validity	11.1 "Bids shall remain valid for a period specified in the BDS after the deadline date for bid submission specified in Clause 19.1 of ITB." 11.2 In exceptional circumstances, prior to expiry of the original time limit, the Employer may request that the bidders may extend the period of validity for a specified additional period. The request and the bidders' responses shall be made in writing or by email. A bidder may refuse the request without 11.3 Forfeiting his Bid Security/ Earnest Money. A bidder agreeing to the request will not be required or permitted to modify his bid, but will be required to extend the validity of his earnest money for a period of the extension, and in compliance with Clause 12 of ITB in all respects.
12. Earnest Money	12.1 The Bidder shall furnish, as part of the Bid, Earnest Money, in the amount specified in the BDS. 12.2 The Earnest Money Deposit (EMD) shall, at the Bidder's option, be in the form of Fixed Deposit Receipt, Bank Guarantee of a scheduled commercial bank, issued in favor of the name given in the BDS& shall be valid for six months or more after the last date of receipt of bids. Earnest money will be deposited, physically, with officer calling tender, before last date of submission of tender. A scanned copy of earnest money document will be submitted along with the tender 12.3 Any bid not accompanied by an acceptable Earnest Money, shall be rejected by the Employer as non-responsive. 12.4 The Earnest Money of unsuccessful bidders will be returned within 60 days of the end of the Bid validity period specified in Clause 11.1 of ITB. 12.5 The Earnest Money of the successful Bidder will be discharged when the Bidder has signed the Agreement and furnished the required Performance Security. 12.6 The Earnest Money may be forfeited: If the Bidder withdraws the Bid after bid opening (technical bid) during the period of Bid validity; (a) In the case of a successful Bidder, if the Bidder fails within the specified time limit to

	(b) Sign the Agreement; and/or (c) Furnish the required Performance Security.
13. Format and Signing of Bid	13.1 Bidders shall submit their Bid electronically. Procedures for submission, sealing and marking are outlined in the ITB16. 13.2 The Bid shall be typed or written in indelible ink and shall be signed by a person duly authorized to sign on behalf of the Bidder. This authorization shall consist of a written confirmation as specified in the BDS and shall be attached to the bid. The name and position held by each person signing the authorization must be typed or printed below the signature.
14. Cost of Bidding	14.1 The Bidder shall bear all costs associated with the preparation and submission of its Bid, and the ***Employer*** shall in no case be responsible or liable for those costs, regardless of the conduct or outcome of the Bidding process.
15. Documents Comprising the Bid	15.1 The Bidder shall furnish, as part of the Technical Bid, a Technical Proposal including a statement of work methods, equipment, personnel, schedule and any other information as stipulated in Section 4 (Bidding Forms), in sufficient detail to demonstrate the adequacy of the Bidders' proposal to meet the work requirements and the completion time.
	Bid Submission
16. Process of e-Bid Submission	16.1 **Instruction for Online Bid Submission** I. Instructions to the Bidders to submit the bids online through the procurement portal for Procurement at http://uktenders.gov.in. II. Possession of valid Digital Signature Certificate (DSC) and enrollment/registration of the contractors/bidders on the e-Procurement/e-tender portal are prerequisite for e- tendering. III. Bidder should read each and every rules/regulations for uploading the bid on the e-procurement portal. 16.2 **Submission of Original Documents**: The bidders are required to separately submit (i) original demand drafts towards the cost of bid document and registration on e-procurement website (if not previously registered) (as per RFP); and (ii) original bid security in approved form; and (iii) original affidavit regarding correctness of information furnished with bid document, in the office **specified in the BDS**, before the opening of the technical part of the Bid, either by registered/speed post/courier or by hand, failing which the bids will be declared non-responsive and will not be opened. Hard copy of rest of the bid or any other document is not to be submitted.

17. Alternative Bids	17.1 Unless otherwise specified **in the BDS**, alternative Bids shall not be considered.
18. Documents Establishing the Eligibility and Qualifications of the Bidder	18.1 To establish its qualifications to perform the Contract in accordance with Section 3 (Evaluation and Qualification Criteria) the Bidder shall provide the information requested in the corresponding information sheets included in Section 4 (Bidding Forms).
19. Deadline for Submission of Bids	19.1 Bids must be uploaded online no later than the date and time **specified In the BDS**. 19.2 The *Employer* may, at its discretion, extend the deadline for the submission of Bids by amending the bidding document in accordance with ITB 6, In which case all rights and obligations of the *Employer* and Bidders previously subject to the dead line shall thereafter be subject to the dead line as extended.
20. Late Bids	20.1 The electronic bidding system would not allow any late submission of bids after due date & time as per server time.
21. Withdrawal, Substitution, and Modification of Bids	21.1 A Bidder may withdraw, substitute, or modify its Bid – Technical or Price prior to deadline for submission of Bids.
	Bid Opening
22. Opening of Technical Bids	22.1 The Employer will open the bids received, on line in the presence of the bidders/bidders' representatives who choose to attend at the time, date and place specified in the BDS. In the event of the specified date for the submission of bids being declared a holiday for the Employer, the Bids will be opened at the appointed time online on the next working day. 22.2 The technical bid shall be opened online. 22.3 The Employer will prepare minutes of the Bid opening, including the information disclosed to those present in accordance with Clause 22.1 of ITB. 22.4 Evaluation of the technical bids with respect to bid security, qualification information and other information furnished in Part I of the bid in pursuant to Clause 4.1 of ITB, shall be taken up and at the end of evaluation of technical bid a list will be drawn up of the responsive bids whose financial bids are eligible for consideration. 22.5 The Employer will notify Bidders in writing who have been rejected on the grounds of their Technical Bid being substantially non-responsive to the requirements of the Bidding Document. 22.6 At the time of the opening of the 'Financial Bid', the names of

	the bidders whose bids were found responsive in accordance with clause 22(iv) of ITB will be announced. The financial bids of only these bidders will be opened. The responsive bidders' names, the Bid prices, the total amount of each bid, and such other details as the Employer may consider appropriate will be announced by the Employer at the time of bid opening. Any Bid price, which is not read out and recorded, will not be taken into account in Bid Evaluation. 22.7 The Employer shall prepare the minutes of the opening of the Financial Bids. 22.8 Process to be Confidential 22.9 Information relating to the examination, clarification, evaluation, and comparison of bids and recommendations for the award of a contract shall not be disclosed to bidders or any other persons not officially concerned with such process until the award to the successful Bidder has been announced. Any attempt by a Bidder to influence the Employer's processing of bids or award decisions may result in the rejection of his Bid 22.10 Clarification of Bids and Contacting the Employer 22.11 No Bidder shall contact the Employer on any matter relating to its bid from the time of the bid opening to the time the contract is awarded. 22.12 Any attempt by the bidder to influence the Employer's bid evaluation, bid comparison or contract award decision may result in the rejection of his bid. 22.13 Examination of Bids and Determination of Responsiveness 22.14 During the detailed evaluation of "Technical Bids", the Employer will determine whether each Bid (a) meets the eligibility criteria defined in Clauses 3 and 4; (b) has been properly signed; (c) is accompanied by the required securities; and (d) is substantially responsive to the requirements of the bidding documents. During the detailed evaluation of the "Financial Bids", the responsiveness of the bids will be further determined with respect to the remaining bid conditions, i.e., priced bill of quantities, technical specifications and drawings. 22.15 A substantially responsive "Financial Bid" is one that conforms to all the terms, conditions, and specifications of the bidding

	documents, without material deviation or reservation. A material deviation or reservation is one (a) which affects in any substantial way the scope, quality, or performance of the Works; (b) which limits in any substantial way, inconsistent with the bidding documents, the Employer's rights or the Bidder's obligations under the Contract; or (c) whose rectification would affect unfairly the competitive position of other Bidders presenting substantially responsive bids. 22.16 If a "Financial Bid" is not substantially responsive, it will be rejected by the Employer, and may not subsequently be made responsive by correction or withdrawal of the nonconforming deviation or reservation.
	Evaluation and Comparison of Bid
23. Confidentiality	23.1 Information relating to the examination, evaluation, comparison, and post qualification of Bid and recommendation of contract award, shall not be disclosed to Bidders or any other persons not officially concerned with such process until information on Contract award is communicated to all Bidders. 23.2 Any attempt by a Bidder to influence the Employer in the evaluation of the Bid or Contract award decisions may result in the rejection of its Bid.
	23.3 Notwithstanding ITB 23.2, from the time of bid opening to the time of Contract award, if any Bidder wishes to contact the Employer on any matter related to the bidding process, it may do so in writing.
24. Clarification of Bids	24.1 To assist in the examination, evaluation, and comparison of the Technical and Price Bid, the Employer may, at its discretion, ask any Bidder for a clarification of its bid or submission in original, of any document submitted in the electronic bid. Any clarification submitted by a Bidder that is not in response to a request by the Employer shall not be considered. The Employer's request for clarification and the response shall be in writing. No change in the substance of the Technical Bid or prices in the Price Bid shall be sought, offered, or permitted, except to confirm the correction of arithmetic errors discovered by the Employer in the evaluation of the Price Bid, in accordance with ITB 27. 24.2 If a Bidder does not provide clarifications of its Bid by the date and time set In the *Employer*'s request for clarification, its Bid may be rejected.
25. Deviations, Reservations, and Omissions	25.1 During the evaluation of Bids, the following definitions apply: (a) "Deviation" is a departure from the requirements specified In the bidding document; (b) "Reservation" is the setting of limiting conditions or with holding from complete acceptance of the requirements

	specified In the bidding document; and "Omission" is the failure to submit part or all of the Information or documentation required In the bidding document.
26. Preliminary Examination of Technical Bid	26.1 The Employer shall examine the Technical Bid to confirm that all documents and technical documentation requested in ITB Sub-Clause 8.2 have been provided, and to determine the completeness of each document submitted.
	26.2 The Employer shall confirm that the following documents and information have been provided in the Technical Bid. If any of these documents or information is missing, the offer shall be rejected. (a) Letter of Technical Bid; (b) Written confirmation of authorization to commit the Bidder; (c) Bid Security, if applicable; and (d) Technical Proposal in accordance with ITB15.
27. Correction of errors	27.1 The e-procurement system automatically calculates the total amount from unit rates and quantities and the system also automatically populates the amount in words from the amount In figures and therefore there is no scope of discrepancy and need for arithmetic correction
28. Evaluation of Price Bid	28.1 The Employer shall use the criteria and methodologies listed in this Clause. No other evaluation criteria or methodologies shall be permitted. 28.2 To evaluate the Price Bid, the Employer shall consider the following: 28.3 the bid price, excluding Provisional Sums and the provision, if any, for contingencies in the Summary Bill of Quantities for admeasurement contracts, or Schedule of Prices for lump sum contracts, but including Day work items, where priced competitively; 28.4 price adjustment for correction of arithmetic errors in accordance with ITB 27.1; 28.5 price adjustment due to discounts offered in accordance with ITB 17.4; 28.6 adjustment for nonconformities in accordance with ITB 30.3; 28.7 application of all the evaluation factors indicated in Section 3 (Evaluation and Qualification Criteria); 28.8 The estimated effect of the price adjustment provisions of the Conditions of Contract, applied over the period of execution of the Contract, shall not be taken into account in bid evaluation.
29. Employer's	29.1 Employer reserves the right to accept or reject any Bid,

Right to accept any Bid and to Reject any or all Bids	and to cancel the bidding process and reject all bids, at any time prior to the award of Contract, without thereby incurring any liability to the affected Bidder or bidders or any obligation to inform the affected Bidder or bidders of the grounds for the Employer's action.
	Award of Contract
30. Award Criteria	30.1 The Employer shall award the Contract to the Bidder whose offer has been determined to be the lowest evaluated bid for aggregate Engineer construction and operation & maintenance and is substantially responsive to the Bidding Document, provided further that the Bidder is determined to be qualified to perform the Contract satisfactorily
31. Notification of Award	31.1 Prior to the expiration of the period of bid validity, the Employer shall notify the successful Bidder, in writing, via the Letter of Acceptance/Award included in the Contract Forms, that its bid has been accepted. 31.2 Until a formal contract is prepared and executed, the notification of award shall constitute a binding Contract. 30.3 At the same time, the Employer shall also notify all other Bidders of the results of the bidding, and shall publish in an English language newspaper or well-known and freely accessible website the results identifying the bid and contract numbers and the following information: (i) name of each Bidder who submitted a Bid; (ii) bid prices as read out at Bid Opening; (iii) name and evaluated prices of each Bid that was evaluated; (iv) name of bidders whose Bid were rejected and the reasons for their rejection; and (v) name of the winning Bidder, and the Price it offered, as well as the duration and summary scope of the contract awarded. After publication of the award, unsuccessful bidders may request in writing to the Employer for a debriefing seeking explanations on the grounds on which their Bid were not selected. The Employer shall promptly respond in writing to any unsuccessful Bidder who, after publication of contract award, requests a debriefing.
32. Signing of Contract	32.1 Promptly after notification, the Employer shall send the successful Bidder the Contract Agreement. 32.2 Within twenty-eight (28) days of receipt of the Contract Agreement, the successful Bidder shall sign, date, and return it to the Employer.
33. Performance Security	33.1 Within 21 (twenty one) days after receipt of the Letter of Acceptance/Award, the successful Bidder shall deliver to the Employer a Performance Security of five (5%) of the Contract Price including GST, valid up to the completion of the DLP

	Period. 33.2 The performance security shall be either in the form of an unconditional Bank Guarantee or fixed deposit Receipts (FDR), in favor of Chief Executive Officer, Dehradun Smart City Limited Payable at Dehradun, Uttarakhand, from a Scheduled Commercial Bank. 33.3 Failure of the successful Bidder to comply with the requirements of Clause 32.1.shall constitutes sufficient grounds for cancellation of the award and forfeiture of the Earnest Money. He will also be debarred from participating in future bids under Dehradun Smart City Limited.
34. Advances:	34.1 The employer will provide mobilization advances and advance against security of equipment as provided in Part I General Condition of Contract. If specified in the tender document.
35. Corrupt or Fraudulent Practices	35.1 The Employer requires the bidders/Contractors to strictly observe the laws against fraud and corruption in force in India, namely, Prevention of Corruption Act, 1988.

SECTION II

BID DATA SHEET (BDS)

Section II – Bid Data Sheet (BDS)

ITB Reference	A. General
ITB 1.1	The number of the Invitation for Bids is: 01/DSCL/20-21/NCB/RRL The Employer is: Chief Executive Officer, Dehradun Smart City Limited The name of the RFP is: Request for Proposal for Rajpur Road Landscaping Project under "Smart City Mission" through e-Procurement.
	Contents of Bidding Document
ITB 5.1	**For clarification purpose only,** the Employer address is: Dehradun Smart City Limited, 777, Saatvik Tower , Rajender Nagar, Kaulagarh Road, Dehradun-248001, Uttarakhand, Email : agmproc-dscl@uk.gov.in
ITB 6.1	Any addendum/clarification shall be uploaded on the portal http://uktenders.gov.in only
	Preparation of Bids
ITB 7.1	The language of the bid is : English
ITB 8.2	The Bidder should also refer to the checklist enclosed in the RFP for submission of the documents.
ITB 9.2	The rates quoted by the Contractor shall be exclusive of GST which will be paid /adjusted by the client at the time of payment of the bills of the Contractor and shall be deemed to be Inclusive of 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 [TDS] as per applicable law.
ITB 11.1	The Bid validity period shall be 90 **days**.
ITB 12.1	The bidder shall furnish a Bid Security/EMD for an amount of **INR 27,000/- (Indian Rupees Twenty Seven Thousand Only)** valid till 45 days beyond the validity of Bids i.e. (90+45 days).
ITB 12.2	The Bid Security/EMD shall be in the form of FDR/TDR payable at Dehradun issued in favor of Chief Executive Officer, Dehradun Smart City Limited.
ITB 13.2	The written confirmation of authorization to sign on behalf of the Bidder shall consist of Legally Enforceable Power of Attorney. For Proprietorship, Power of Attorney is Not Applicable.
	Bid Submission
ITB 16.2	The date and time for submission of original documents like RFP Document Fees(Non-Refundable), Bid Security/EMD and Affidavit for Correctness of Bid is: **Date: 14/12/2020** **Time: Up to 1100 Hours** Place: Dehradun Smart City Limited, 777, Saatvik Tower , Rajender Nagar, Kaulagarh Road, Dehradun-248001, Uttarakhand
ITB 17.1	Alternative Bids shall not be permitted.

ITB 19.1	The deadline for uploading the Bids is: **Date: 14/12/2020** **Time: Up to 1030 Hours** Place: Dehradun Smart City Limited, 777, Saatvik Tower , Rajender Nagar, Kaulagarh Road, Dehradun-248001, Uttarakhand
	Bid Opening
ITB 22.1	The online Bid opening of Technical Parts of Bids shall take place at: Dehradun Smart City Limited, 777, Saatvik Tower, Rajender Nagar, Kaulagarh Road, Dehradun-248001, Uttarakhand. **Date: 14/12/2020** **Time: 1130 Hours**

SECTION III

EVALUATION AND QUALIFICATION CRITERIA

Section III - Evaluation and Qualification Criteria

1.0 EVALUATION

The bidder shall fulfill the following qualifying requirements:-

1.1 Adequacy of Technical Proposal

Evaluation of the Bidder's Technical Proposal will include an assessment of the Bidder's technical capacity to mobilize key equipment and personnel for the contract consistent with its proposal regarding work methods, scheduling, and material sourcing in sufficient detail and fully in accordance with the requirements stipulated in Section 5 (Scope of Work).Non-compliance with equipment and personnel requirements described in Section 5 (Scope of Work) shall not be grounds for bid rejection and such non-compliance will be subject to clarification and rectification prior to contract award.

2.0 Qualification Criteria

The Technical Bids will be evaluated based on the following criteria

Sr. No	Criteria	Requirement	Submission Requirement
1	Annual Supply/Construction Turnover	The Bidder shall have minimum annual turnover in any of the last five financial years for a value of **INR 13.50 Lakhs Only.**	Form Fin 2
2	Specific Construction Experience in Similar works	Bidder should have successfully completed as a prime contractor, JV member, management contractor or sub-contractor at least one work during the last seven years and experience certificate should be attached with this RFP • One similar work of contract value INR 10.80 Lakhs OR • Two similar works of contract value INR 6.75 Lakhs. OR • Three similar works of contract value INR 5.40 Lakhs	Form EXP 1(a) with attachments

SECTION IV

BIDDING FORMS

Note: Each filled form should contain the Project Name and RFP Ref No.

Letter of Technical Bid
Ref No._____ Date of Bid submission: _____
RFP No.: _____

To: The Chief Executive Officer,
Dehradun Smart City Limited,
777, Saatvik Tower, Rajender Nagar,
Kaulagarh Road, Dehradun-248001, Uttarakhand

We, the undersigned, declare that:

We have examined and have no reservations to the Bidding Documents, including Addenda issued in accordance with Instructions to Bidders (ITB-8);

We offer to execute works in conformity with the Bidding Documents the following Work/s: _____.
Our bid shall be valid for a period of 90 days from the bid submission due date in accordance with the bidding documents, and it shall remain binding up on us and may be accepted at any time before the expiration of that period;

If our bid is accepted, we commit to obtain a performance security in accordance with the Bidding Documents;

We, including any subcontractors or suppliers for any part of the contract, do not have any conflict of interest in accordance with ITB 3.3;

We are not participating, as a Bidder or as a subcontractor, in more than one bid in this bidding process in accordance with ITB3.3,

Our firm, its affiliates or subsidiaries, including any Subcontractors or Suppliers for any part of the contract, has not been declared ineligible by Government of Uttarakhand (GoUK)/ Government of India (GoI) or any of its undertakings/ Other Departments any State Government, any public sector unit or any Local Body.

We are not a government owned entity / We are a government owned entity but meet the requirements of ITB 3.5;*

We understand that this bid, together with your written acceptance thereof included in your letter of award, shall constitute a binding contract between us, until a formal Contract is prepared and executed.

We agree to permit Dehradun Smart City Limited or its representative to inspect our accounts and records and other documents relating to the bid submission and to have them audited by auditors appointed by Dehradun Smart City Limited or Government of India.

Name.....
In the capacity of.....
Signed.....
Duly authorized to sign the Bid for and on behalf of.....
Date.....

Construction Schedule

[Insert Construction Schedule]

Form ELI-1: Bidder's Information

Bidder's legal name	
Bidder's country of constitution	
Bidder's year of constitution	
Bidder's legal address in country of constitution	
Bidder's authorized representative (name, address, telephone numbers, fax numbers, e-mail address)	

Form FIN – 1: Financial Situation and Performance

Information from Balance Sheet					
	2019-20	2018-19	2017-18	2016-17	2015-16
Total Assets (TA)					
Total Liabilities (TL)					
Net Worth (NW)					
Current Assets (CA)					
Current Liabilities (CL)					
Working Capital (WC)					
Total Revenue (TR)					
Profits Before Taxes (PBT)					
Profits After Taxes (PAT)					
Cash Flow from Operating Activities					

NOTE: THE FIGURES FILLED BY THE BIDDER IN THE ABOVE FORMAT SHOULD ALSO BE CERTIFIED BY THE CHARTERED ACCOUNTANT.

Form FIN - 2: Average Annual Turnover

Annual turnover data	
Year	Amount in INR
2019-20	
2018-19	
2017-18	
2016-17	
2015-16	
Average Annual Turnover *	

Annual construction turnover calculated as total certified payments received for work In progress or completed, for last five FY (2015-16, 2016-17,2017-18, 2018-19 and 2019-20) of the Bidder and should be certified by a Chartered Accountant.

Form EXP – 2 : Specific Construction Experience
[The following table shall be filled in for contracts performed by the Applicant]

Similar Contract No.	Information			
Contract Identification				
Award date				
Completion date				
Role of contractor	Prime Contractor	Member In JV	Management Contractor	Sub-contractor
Total Contract Amount			Rs *	
If member In a JV or subcontractor, specify participation In total Contract amount			*	
Employer's Name:				
Address: Telephone/fax number E-mail:				

Note:

☐ Attached are completion certificates from the competent authority

Form of Bid Security(EMD, Bank Guarantee)

.....Bank's Name, and Address of Issuing Branch or Office.....
Beneficiary: ..... Name and Address of Employer.....

Date:.....
.....

Bid Security No.:
We have been informed that . . . . . name of the Bidder (hereinafter called "the Bidder") has submitted to you its bid dated . . . . . (Hereinafter called "the Bid") for the execution of.....name of contract.....under Invitation for Bid No.....("the IFB").
Furthermore, we understand that, according to your conditions, Bid must be supported by a bid guarantee.

At the request of the Bidder, we . . . . . name of Bank hereby irrevocably undertake to pay you any sum or sums not exceeding in total an amount of amount in figures. …….. (.....amount in words) upon receipt by us of your first demand in writing accompanied by a written statement stating that the Bidder is in breach of its obligation(s) under the bid conditions, because the Bidder:

has withdrawn its Bid during the period of bid validity specified by the Bidder in the Form of Bid; or

does not accept the correction of errors in accordance with the Instructions to Bidders (hereinafter "the ITB");or

Having been notified of the acceptance of its Bid by the Employer during the period of bid validity, (i) fails or refuses to execute the Contract Agreement, or (ii) fails or refuses to furnish the Performance Security, in accordance with the ITB.

This guarantee will expire: (a) if the Bidder is the successful Bidder, upon our receipt of copies of the Contract Agreement signed by the Bidder and the performance security issued to you upon the instruction of the Bidder; and (b) if the Bidder is not the successful Bidder, upon the earlier of (i) our receipt of a copy your notification to the Bidder of the name of the successful Bidder; or (ii) twenty-eight days after the expiration of the Bidder's bid.

Consequently, any demand for payment under this guarantee must be received by us at the office on or before that date.

. . . . . Bank's seal and authorized signature(s) . . . . . .
Note: All italicized text is for use in preparing this form and shall be deleted from the final document

Format for Declaration by the bidder for not being Blacklisted / Debarred

(To be submitted on the Letterhead of the bidder)

Date: dd/mm/yyyy

To: The Chief Executive Officer,
Dehradun Smart City Limited,
777, Saatvik Tower, Rajender Nagar,
Kaulagarh Road, Dehradun-248001, Uttarakhand

Subject: Request for Proposal for _____
.
RFP Reference No:

Dear Sir/ Ma'am,

I, authorized representative of _____, hereby solemnly confirm that the _____ ("Successful bidder") is not debarred/ black -listed by Central Government/ any State Government/ Public Sector Undertaking in India or similar agencies globally for unsatisfactory past performance, corrupt, fraudulent or any other unethical business practices or for any other reason as on last date of submission of the bid.

In the event of any deviation from the factual information/ declaration, DEHRADUN SMART CITY LIMITED reserves the right to reject the bid or terminate the Contract without any compensation to the Company.

Thanking you,
Yours faithfully,

_____ _____
Signature of Authorized Signatory (with official seal)

Date:
Name:
Designation:
Address:
Telephone & Fax: E-mail address:

Format of sending pre-bid queries at agmproc-dscl@uk.gov.in

RFP Reference No:

Bidder's Request For Clarification				
Name and complete official address of Organization submitting query/request for clarification			Telephone, Fax and E-mail of the organization Tel: Fax: Email:	
S. No.	Clause No.	Page No.	Content Of RFP Requiring Clarification	Change Requested/ Clarification required
1				
2				

Signature:
Name of the Authorized signatory:
Company seal:
Date and Stamped

Note: Bidder(s) are requested to send the queries in PDF with Sign and Company Seal and also in MS Excel/word for making consolidation process easy.

Format for Power of Attorney

(On a non-judicial stamp paper of appropriate value duly attested by notary public)

Know all men by these presents, we (name and address of the registered office of the Sole Applicant) do hereby constitute, appoint and authorize Mr./Ms _____R/o _____ who is presently employed with us and holding the position of_____, to do in our name and on our behalf, all such acts, deeds and things, necessary in connection with or incidental to the bid for Request for Proposal for _____ including signing and submission of all documents and providing information/ responses to DEHRADUN SMART CITY LIMITED and representing us in all matters in connection with our bid for the said Project.

We hereby agree to ratify all acts, deeds and things lawfully done by our said attorney pursuant to this Power of Attorney and that all acts, deeds and things done by our aforesaid attorney shall and shall always be deemed to have been done by us.

For (Signature)

(Name, Title and Address)

Accept

…… (Signature)

(Name, Title and Address of the Attorney)

Notes:

To be executed by the Applicant.
The mode of execution of Power of Attorney should be in accordance with the procedure, if any, laid down by the applicable law and the charter documents of the executant(s) and when it is so required the same should be under common seal affixed in accordance with the required procedure.
Also, wherever required, the executant(s) should submit for verification the extract of the charter documents and documents such as a resolution/ Power of attorney in favour of the Person executing this Power of Attorney for the delegation of power hereunder on behalf of the bidder.

FORMAT FOR AFFIDAVIT FOR CORRECTNESS OF BID

(To be given by the Bidder on non-judicial Stamp Paper of Rs. 100/-)
I.……..……..... S/o ……..……..……..., Resident of the ……..……,
…….... (Insert designation) of the ……..….... (Insert name of the Bidder), do solemnly affirm and state as under:

1. That I am the authorized signatory of ……..(insert name of company) (hereinafter referred to as "Bidder") and I am duly authorized by the Board of Directors of the Bidder to swear and depose this Affidavit on behalf of the bidder.

2. That I have submitted information with respect to our eligibility for the "_____(hereinafter referred to as "Project") and I further state that all the said information submitted by us is accurate, true and correct and is based on our records available with us.

3. That I hereby affirm to furnish any information, which may be requested by Authority to verify our credentials/information provided by us under this Bid and as may be deemed necessary by Authority.

4. That if any point of time till the completion of all the contractual obligations, in case Authority requests any further/additional information regarding our financial and/or technical capabilities, or any other relevant information, I shall promptly and immediately make available such information accurately and correctly to the satisfaction of Authority.

5. That I fully acknowledge and understand that furnishing of any false or misleading information by us in Bid shall entitle us to be disqualified from the tendering process for the said Project. The costs and risks for such disqualification shall be entirely borne by us.

6. That, we fully acknowledge and understand that in case any false or misleading information, as furnished by us in our Bid, is found at a later stage after the signing of the Contract Agreement amongst Authority and …….. (Insert name of organization), it shall entitle DSCL to terminate the said signed Contract Agreement between the Parties. The costs and risks for such termination shall be entirely borne by us.

7. That all the terms and conditions of the Tender Document have been duly complied with.

VERIFICATION:
I, the above named deponent, do verify that the contents of points 1 to 7 of this affidavit are true and correct to my knowledge. No part of it is false and nothing material has been concealed.
Verified at ……, on this ……. day of…….……., 2019.

Checklist for Technical & Financial Bid

S. No.	Particulars	Yes/No	If Yes, Page No.
1	RFP Document Fees		
2	Bid Security/EMD		
3	Affidavit of Correctness of Bid		
4	Power of Attorney (If applicable)		
5	Undertaking to the effect that the company has not been black-listed(duly notarized)		
6	Copy of PAN CARD issued by income tax department with copy of income tax returns for the last three FY		
7	Copy of GST Registration Certificate		
8	Copy of Incorporation/Company Registration Certificate		
9	Letter of Technical Bid		
10	Construction Schedule		
11	Form ELI-1: Bidders Information		
	Form FIN-1: Financial Situation and Performance		
12	Form FIN-2: Average Annual Turnover		
13	Form EXP-2: Specific Construction Experience		
14	Any other relevant document		

SECTION 5
Scope of Work & Technical Specifications

This Section contains the Specification, the Drawings, and supplementary information that describe the Works to be procured. The specifications of the Equipments mentioned in the documents shall govern; and the equipment supplied, installed by the Contractor shall comply with stipulated specifications. The make/ manufacturer of the equipment if mentioned inadvertently in the bidding document shall have no effect.

5.1 Project Information

Government of India launched the Smart Cities Mission to enable the holistic development of Indian cities. This initiative under the Ministry of Urban Development (MoUD) aims to drive economic growth and improve the quality of life of people by enabling local development and harnessing technology as a means to create smart outcomes for citizens. According to MoUD, the core elements of a Smart City include: adequate water and electricity supply, suitable sanitation and solid waste management, efficient public transportation, affordable housing, robust IT connectivity and digitalization, e-governance with citizen participation, sustainable environment, and safety and security of citizens with health and education for all. These objectives are proposed to be attained through a judicious mix of retrofitting, Rejuvenation and Greenfield development.

In the approach of the Smart Cities Mission, the objective is to promote cities that provide core infrastructure and give a decent quality of life to its citizens, a clean and sustainable environment and application of 'Smart' Solutions. The focus is on sustainable and inclusive development and the idea is to look at compact areas, create a replicable model which will act like a light house to other aspiring cities. Dehradun the capital city of Uttarakhand was included in the Smart City Program – given it's importance as a State Capital and also a gateway to all tourist facilities – both adventure and religious in the state. After due public consultation,

Due to urbanization, there is tremendous pressure on open spaces as there is high population density and rapid development in such urban areas and it is one of the reasons for underdevelopment of urban greenery sector. This highly affects forests, landscaping, urban green areas in and around cities.

Green urban areas refers to public accessible areas within open space that involve green elements. Green spaces also provides social interaction and for recreation. Green urban areas facilitate physical activity and relaxation, and form a refuge from noise. Green spaces also are important to mental health. Having access to green spaces can reduce health inequalities, improve well-being, and aid in treatment of mental illness.

Purpose of green spaces is to improve quality of urban areas and especially neighborhoods; to make urban areas more attractive and to enhance well-being of local people and tourists.

Planning may help in conserving open space. Without careful planning, cities will be stressed with environmental challenges.

Intensive urbanization has left hardly any horizontal space for urban greenery. It can be done in Public areas, along the roads, junctions, highways etc. It is important to landscape roads as they are the channels of movement and it is desirable to make the experience on them comfortable and pleasant.

Road landscaping aims at aligning roads in a visually aesthetic manner. Road landscaping forms an integral part of landscape planning from urban design viewpoint. It makes the cities more comfortable places to live in, aesthetically and visually more pleasant-looking. Also Public open space is necessary to retain urban quality. Open space provides recreational areas for residents and helps to enhance the beauty and environmental quality of neighborhoods.

A lush, verdant landscape with spaces is proposed at site so as to take rest, relax and enjoy the quality time with the nature. A well-defined urban green space is created which provides recreational area which would act as public space including an open green space. It will be easily accessible by public. A small pocket of landscaping with seating spaces is created to relax and

enjoy the greenery. Site is illuminated with the help of the lighting on the building façade and on landscaping part. Proposed Site may act as landmark in Dehradun city.

5.1.1 SCOPE OF WORK:

1. To provide urban green space which provides recreational area for the community and for neighborhoods under Smart City Mission.
2. To preserve a part of Old UPCL building along Rajpur road.

5.1.2 Site of work The proposed site for Landscaping is along Rajpur road in ABD area. Proposed site area is around 208.90 sq.m out of which landscape area which is going to develop is around 137.988 sq.m. Site is located at old Uttarakhand Power Corporation limited (UPCL) office which is adjacent to Anandum shop along Rajpur road. The land is situated from clock tower is around 1.5 km. The land is regular in shape and is surrounded with commercial buildings and it consists of Old UPCL building, part of which demolished and part of it needs to be retained. There is no vegetation on the site as the land as being used for an office.

Location of Old Uttarakhand Power corporation limited (UPCL), Rajpur road

List of Plants and Shrubs used on site

S.no	Type	Botanical Name	Local Name
1	Tree	Thuja compacta	Peacock feather
2	Tree	Plumeria Alba	Frangipani
3	Plant	Areca Palm	Butterfly palm
4	Plant	Livistona palm	Chinensis Fan Palm/ Fountain Palm
5	Shrub	Iresine Herbestii	Bloodleaf
6	Shrub	Alpinia Variegate	Variegated Shell Ginger

TECHNICAL SPECIFICATIONS FOR AVENUE TREES PLANTING AND MAINTENANCE WORKS

1) MAINTENANCE: The CONTRACTOR shall maintain all planted areas in stretch for a period of twenty four months Maintenance shall include watering, weeding, aeration of plants, manuring (organic and inorganic), control of insects fungus and other diseases, pruning adjustments and repairs of stacks, anchors etc. CONTRACTOR should also carry out repair, minor washouts and other Horticultural operations necessary for proper growth of plants.
CONTRACTOR should keep the landscape area neat in appearance and free from pest and diseases, with requisite manpower. He should remove the casualties and carry out replacements with specified same species. The replaced trees should be of the same height as neighboring plants planted earlier, without any additional cost to EMPLOYER.

2) **WATERING:** For every tree sapling minimum of 20 ltrs of water should be provided on every alternate day. Water will be sourced by CONTRACTOR through tankers; however watering with proper methodology shall be the integral responsibility of the CONTRACTOR. Watering should be done from tanker with a hose fixed with sprinkler or sprayer. Watering is to be done by the CONTRACTOR according to weather and stage or period of frequency growth of plant. All new planting should be watered properly before and after planting to bring the soil to optimum moisture content. Watering should be carried out for the entire period of the contract.

3) WEEDING : Weeds should be removed with their roots and dumped away from planted areas. In some seasons frequent weeding will be necessary and weeding should be continued until the trees are large enough to avoid being smothered. Only selective weed killers approved by Site In-charge shall be applied. The CONTRACTOR shall be held liable for ensuring that all chemicals are stored and supplied strictly in accordance with the manufacturer's instructions and prevailing Fertilizer & Pest Control Board, Government of India.

4) HOEING OR FORKING: Surface soil around the plants shall be loosened up to 150mm and turned inside out, so as to keep it porous and improve moisture retention capacity as and when required.

5) PEST AND DISEASE CONTROL: Whenever mechanical or chemical control methods are followed advice from Site In-charge should be sought to detect the actual disease. Insecticides used should be in accordance with the manufactures instructions. Plants should be regularly checked to detect any plant disease and control and preventive measures should be sought at the earliest and the same should be informed to Site In-charge.

6) STACKING: Stacks should be used with a non toxic wood preservative. Stacks should be pointed at butt end and should have a minimum diameter of 50mm.They should be 3.0m long and 30 cm of stacks is to be driven into the soil. Place ties at top, middle and bottom of trunk to keep tie secure. Depending on the requirement, multiple stacks should be provided. CONTRACTOR shall carry out periodic maintenance of stacks and ties.

7) TIE: Tie should be strong and rigid enough to hold the tree stem in all probable weather conditions. It should be appropriately dimensioned to allow the tree stem to grow naturally without damage. No material should be used as ties that may rub back.

8) MANURING: Only well decayed and fully decomposed organic manures shall be used. Quantity of organic manure and their frequency of application would depend on type of soil, however regular manuring in small doses should be done once in three months, instead of casual

heavy manuring. Raw manure should not come in direct contact with plant. For inorganic fertilizer application, Site In charge's advice should be taken before application. This would depend on considerations sought such as size, age, condition & species of tree, soil type, pH and nutrient state of soil, type and speed of response needed from fertilizer etc. Mulches shall be approved friable composted organic materials. Initial mulching is to take place within two days of installation of planting. Mulches are to be applied in a 50mm layer over the entire surface of shrub and ground cover areas. Mulching to be reapplied to planting areas every 3 months after initial installation until the end of the maintenance period or until complete surface cover by vegetation is achieved.

9) PRUNING AND RESTORE: Upon completion of planting work all trees which require pruning should be pruned and injuries repaired. Pruning should be done so as not to change the nature habit or special shape of the tree. All cuts should be made flush leaving no stubs. Wounds should be smoothed so as not to retain water. The cuts should be treated to prevent growth of fungus.

10) REPLACEMENT OF PLANT MATERIAL: Plants found damaged / mortal are to be replaced within 15 days time. If the CONTRACTOR fails to replace the plant within 15 days the DSCL reserves the right to replace it and recover the cost for the same from the CONTRACTOR's bill / security deposit.

12) ADDITIONAL CONDITIONS

a) **CONTRACTOR** will have to make his own arrangements for tools & tackles required for the work and DSCL will not supply any tools and tackles unless otherwise specified.

b) **The CONTRACTOR** must take all precautions to avoid all accidents by exhibiting necessary caution boards, speed limit boards, red flags and red lights and providing barriers. He shall be responsible for all damages and accidents caused due to the negligence on his part. No hindrance shall be caused to traffic during execution of work.

c) **The CONTRACTOR** shall maintain the saplings in good condition till the completion of the entire maintenance period allotted to the CONTRACTOR.

d) No compensation shall be payable to the CONTRACTOR for any damage caused by rains, wind, floods during maintenance of work. Nothing extra will be payable on this account.

e) As per the tender conditions, required manpower, authorized Supervisor has to be present in the work site. Separate register for attendance has to be maintained in the site, which will be periodically monitored by DSCL and payments shall be made accordingly. If CONTRACTOR fails to maintain such requirement the necessary cost deduction towards such lapse shall be done by DSCL on pro-rata basis.

f) CONTRACTOR shall clear the site throughout the entire maintenance period. Lift out of waste materials immediately on completion of the replacement of defective plants and properly clean the site to the satisfaction of the DSCL, otherwise the site will be cleared by the department and cost shall be deducted from the monthly bills.

g) At least one authorized representative should always be available at site of work to take instructions from departmental office and ensure proper maintenance / execution of work

h) The DSCL or any authorized agency by DSCL will monitor progress of planting and status of plantations on continuous basis.

i) This agency shall carry out the site visit for field verification in respect of survival, growth and size of plantation and maintenance of the same.

j) The project coordinator of the plantation agency will submit Progress report to the monitoring Agency

k) The contractor shall coordinate and arrange for a kick-off meeting with all the pertinent stakeholders. (Traffic Police, Police, DSCL, BSNL, MDDA, NAGAR NIGAM, PWD, UPCL etc)

l) Bidder/contractor shall submit Plantation plan and to Dehradun Smart City Limited (DSCL) and have it approved prior commencing the works.

m) The trees will be shifted/ transplanted in accordance and consultations with the DSCL and forest officials or relevant authorities.

a. Construction Phase

a) Follow all aspects of labor regulations, health and safety during the contract;

b) Site clearing and grubbing within the Right of Way.

c) Shifting or transplanting of trees as per the drawings included in the tender.

d) Excavation for utilities, road works, footpaths pedestrian tracks, landscaping, street lighting etc.

e) Filling with suitable material as approved by the E in C.

f) Removal of existing pavement and stack or dispose the excavated road materials as indicated by the E in C.

g) All dismantled materials shall be stacked or disposed by the bidder as directed by the E in C.

h) Supply & Install Grass, Palms, trees, shrubs, hedges.

i) Landscaping work including the stone flooring, cc paver block, tiling, grating, saucer drain, cladding, painting etc

j) The bidder/contractor shall work in co-ordination with Smart Features contractor (Smart Features works shall start parallel with this contract at appropriate time);

Note: Construction material such as cement, steel, aggregates, bitumen etc when arranged by the contractor shall produce a test certificate for the whole lot as per the IS Code provisions from an authorized laboratory approved by the Engineer-in-charge.

b. Post Construction Phase

a) Clearing of site and handing over of the works;

b) Rectification of the defects in the completed works during the Defects Liability Period. All defective works are liable to be demolished, rebuilt and defective materials replaced by the Contractor at his own cost. In the event of such works being accepted by carrying out repairs etc. as specified by the Engineer, the cost of repairs shall be borne by the Contractor.

c) Knowledge transfer and capacity building of the line department of the DSCL during the O&M period prior to handing over of the site.

d) The taking over certificate of the work as per the provision of relevant clause of this Contract document, shall not be issued by the Engineer-in-charge in the event of the Contractors failures to furnish the aforesaid "As Constructed' drawings (completion drawing) as mentioned herein this agreement for the entire works.

5.1.2.1 Maintenance Programme

The Contractor shall prepare a monthly maintenance programme (the Maintenance Programme") in consultation with the E in C and submit the same to the E in C not later than 10 (ten) days prior to the commencement of the month in which the Maintenance is to be carried out. For this purpose, a joint monthly inspection by the Contractor and the E in C shall be undertaken. The Maintenance Programme shall contain the following:

a) The proposed maintenance works; and
b) Deployment of resources for maintenance
c) Frequency and turnaround time for addressing the issue.

SECTION V

PART-2

TECHNICAL SPECIFICATIONS

5.2 General

5.2.1 Materials

The term "Materials" shall mean all materials, goods and articles of every kind whether raw, processed or manufactured and equipment and plant of every kind to be supplied by the Contractor for incorporation in the works.

Except as may be otherwise specified for particular parts of the Works the provision of clauses in "materials and workmanship" shall apply to materials and workmanship for any part of the works.

All materials shall be new and of the kinds and qualities described in the Contract and shall be approved by the Engineer in- charge.
Materials shall be transported, handled and stored in such a manner as to prevent deterioration, damage or contamination failing which such damaged materials will be rejected and shall not be used on any part of the Works under this contract.

5.2.2 General Specifications for Materials and Civil Works

All materials required for the works shall be procured and supplied by the contractor himself. The materials shall be new and of good quality and conforming to relevant BIS. The materials which are classified for ISI marking should be supplied with ISI marking only.

5.2.1.1 Cement and Reinforcement:

The entire quantity of cement and steel required for the work will be procured by the contractor. The contractor is responsible for all transport and storage of the materials and shall bear all related costs. The Employer shall be entitled at any reasonable time to examine the cement and steel supplied by the contractor.

The cement procured by the contractor shall comply with the requirements of IS 269 with the latest revision thereof for 33 grade ordinary Portland cement and IS 8112 with the latest revision thereof for 43 grade ordinary Portland cement IS: 12269 with the latest revision therefore 53 grade ordinary Portland cement. It shall be of the best normal setting quality unless specially rapid hardening or quick setting quality if expressly instructed by the Engineer to be supplied. Each bag shall bear ISI Certification mark and as per CPWD specification.

5.2.1.2 Steel for reinforcement shall be high yield strength deformed bars having specific corrosion resistant characteristics (SAIL/RINL/Shayam/TATA TMT HCR &Tiscon TMT CRS). The steel shall be of Grade Fe 415 / Fe 500 and shall have mechanical properties as per IS 1786. For each batch of materials supplied Manufacturer's Test Certificate shall be submitted for approval. This certificate shall clearly state that the material being supplied is Corrosion Resistant Steel and has been tested for corrosion resistance properties. The chemical composition of the steels shall be satisfy the requirements for corrosion resistant steel bars. In general the following shall not be exceeded; Carbon .25%, Sulphur .055%, Phosphorus .12%, S+P .175%, Silicon .45%, Manganese 1.2%, Corrosion Resistance Elements 1.5%. Salt Spray Test as per ASTM: B117–94 for 96 hours may be conducted and the resulting Corrosion Resistance Index shall not be less than1.5.

All reinforcing steel shall be clean and free from oil, grease, loose scales or rust or other coatings of any character which would reduce or destroy the bend. Each bundle containing the bars shall bear the ISI Certification mark.

All structural steel works shall conform to the following, amongst others, recently published publications of the BIS (Bureau of Indian Standards): IS 800, 806, 816, 817, 875, etc. Finishing provided shall comply with requirements of durability and exposure – as directed by the engineer. Corrosive resistant steel primers such as Red Oxide Zinc Chromate with minimum two coats of protective synthetic enamel finish shall be used. In locations of severe exposure such as directly in contact with sewage two coats of epoxy paint shall be applied and the provided thickness of members shall be 2mm more than required, with minimum thickness being 6mm. Mandatory tests and certifications shall be as per codes and specifications.

All inserts and embedment should be clearly shown in the drawings and placed in position during concreting. Rungs should be PVC encapsulated and provided with access bars. Ladders should be of stainless steel.

5.2.1.3 The cement/ steel shall be tested in nearby laboratories of Polytechnic or Engineering College by the Employer. Two samples should be taken by the Engineer in charge in the presence of the contractor or his authorized representatives or the technical personnel employed by the contractor as in the agreement. The contractor shall without extra cost provide samples and cooperate in the testing of the cement/ steel. One sample shall be got tested and the other sample shall be retained by making clear identification in the sample by the Engineer in charge so as to identify at a later date. The cost of such test shall be borne by the contractor.

5.2.1.4 All cement shall be procured in bags and shall be stored in a dry place for which the contractor shall be responsible. Consignment of bagged cement shall be properly stacked in a manner which will permit easy access for inspection and definite identification. Cement shall be used in approximately in the chronological order in which it is received, but cement that has been stored for a period longer than 4 months from the date of initial sampling shall not be used unless it has been retested at the expenses of the contractor and passed by the Engineer in charge as good quality on the retest. Cement aged more than 180 days from the date of initial sampling shall be rejected.

5.2.1.5 Cement which has become caked or perished shall on no account be used on the works and shall be rejected. Although the Engineer may have passed any consignment, he shall however have the power at the subsequent time to reject such consignment if he finds that any deterioration in the quality thereon has taken place.

5.2.1.6 A record of the quantity of cement/ steel procured with the name of dealer, bill number and date shall be maintained by the contractor. This should be produced for examination by the Engineer in charge at any time. The age of the cement shall be reckoned from the date of manufacture and it shall be verified by the Engineer in charge.

5.2.1.7 The rejected consignment of cement and steel should be removed from the site within two days.

5.2.1.8 Aggregates:

5.2.1.8.1 Sand for use in masonry and plaster works shall conform to relevant CPWD specification and I.S.2116, I.S.1542.

5.2.1.8.2 The coarse and fine aggregates for concrete shall conform to I.S.383 and as specified in the relevant clauses of I.S.456. Other aggregates free from deleterious materials shall be used at the concurrence and approval of the Engineer after sufficient tests have been carried out at the contractor's cost.

5.2.1.8.3 The maximum quantities of deleterious materials in the aggregates, as determined in accordance with I.S.2386 (Part II) shall not exceed the limits given in table I of I.S.383. Unless otherwise specified all coarse aggregate in RCC shall be graded aggregate of 20mm nominal size. All aggregates shall be stored in hard impervious surface to ensure exclusion of all foreign materials and as per IS 4082 and CPWD specification.

5.2.1.8.4 Aggregate having a specific gravity below 2.6 (saturated surface dry basis) shall not be used without the special permission of the Engineer.

5.2.1.9 Bricks:

5.2.1.9.1 **Manufacture:**

Common burnt clay building bricks shall conform to the requirements of IS 1077 and shall be of quality not less than class 50 with moisture absorption rate not exceeding 15% as defined in IS: 1077. The bricks shall be chamber burnt and shall not be damaged in any manner and sizes shall conform to the works sizes specified with tolerance as given in 6.2 of IS: 1077.

5.2.1.9.2 Samples*:*

The Contractor shall deliver samples of each type of brick to the Engineer, and no orders shall be placed without the written approval of the Engineer. All the bricks used in the works shall be of the same standard as the approved samples. The samples shall be preserved on site, and subsequent deliveries shall be checked for uniformity of shape, colour and texture against the samples. If in the opinion of the Engineer any deliveries vary from the standard of the samples, such bricks shall be rejected and removed from the site.

5.2.1.9.3 Uniformity**:**

The bricks selected for exposed pointed brickwork walls shall be of uniform colour, deep cherry red or copper colour and uniform texture.
Only such bricks as are permitted by the Engineer shall be used.

5.2.1.3.1 Testing:

Samples of the bricks shall be tested in accordance with IS: 3495 by the Contractor for compliance with the aforesaid, before any order is placed, and soon after receipt of a

consignment. Tests shall be carried out as and when required by the Engineer on samples selected by the Engineer's representative.

5.2.1.5.1 R.C.C.PIPE

Reinforced cement, concrete pipes NP3/ NP4 class (rubber ring roll on joint) shall be procured by contractor conforming to the Indian Standard Specifications No. 458 (latest addition).

5.2.1.5.1.1 MATERIALS (RAW &MANUFACTURED)

The contractor shall procure, provide and supply and include in his rates for all labour, materials, tools and plants required temporarily or permanently on the works that may become proper or necessary to complete the execution of the work in all respects.

The sand used on the "Works" for cement mortar, lime mortar, cement concrete and other purpose shall comply in every respect with public works department detailed specification No. 7 Part-I Section-DA (Buildings) of public works department.

These materials shall comply in every respect with the respective clauses of the P.W.D. detailed specification, Part-I Section-'A' (Buildings) which shall be deemed to be incorporated in this contract. Contractor shall be responsible for the safe cartage, storage and use of these materials.

5.2.1.5.1.2 WORK & WORKMANSHIP

The tenderer are advised to inspect the sites at which the work is to be carried out so that they may form their own idea regarding the difficulties in transportation of materials and execution of work.

They are also advised to make their own investigations regarding the conditions of underground sub-soil conditions & strata, availability of materials and water required for construction and tests so that they may quote their rates after accounting for all the difficulties and making provisions for the complete items of works. It may be noted by the tenderer that the various items of works included in BOQ required to be executed for construction of water retaining structures have to be executed with all due care so that the water retaining structures remain completely water tight. The contractor shall be responsible for the complete water tightness of the pipe line joints, and reservoirs and other similar water tight structures and he will be required to give a water tightness test for the same at his own cost, in a manner as described at appropriate places, to the satisfactions of the Engineer in charge.

When shingles are used in concrete work, then a deduction equal to 7 (seven) percent shall be accounted to work out actual consumption of cement. In case when shingles are used consumes more cement, then after accounting above deduction, then recovery for the extra consumption shall be effected at double rates for the wasteful consumption, as per condition of schedule-I. The contractor should make himself familiar with the actual cement consumption figures for different mixes before carrying any particular work. The theoretical consumption figures, as workout during the progress of work should tally with the consumption figures, of course after accounting the deductions as mentioned above for shingle.

Leaving aside the case when specific written orders exits, the contractor in no case should use extra cement than the norms fixed for particular work which can be had from

the respective office on written request. In case if the contractor does consume extra cement then treating it as a wasteful expenditure no payment will be made to contractor for said wasteful expenditure. The contractor's rate shall include for carting the material to site of work and embedding the same in PCC as shown in the drawings. All other chambers shall be constructed as per type design and the item of works involved in construction of the same shall be as per relevant P.W.D detailed specifications.

The cement concrete work shall be carried out as per P.W.D. detailed specifications. No. 30 and 31 of Part-I section 'A' (Buildings). The coarse aggregate shall consisting of approved shingle aggregate or hard stone ballast of 40 mm. gauge for

P.C.C. 1:4:8 and 20mm. gauge for P.C.C. 1:1.5:3. The face stones shall be laid in alternate headers and stretchers. The stones shall break joints on the faces for at least

½ the height of the coarse. The walls and pillars shall be carried up truly plumb and all courses shall be laid truly horizontal. Each stone shall be laid with both bed & vertical joints quite full of mortar. Simple lapping at the edges shall not be permitted. No face joint shall be thicker than 10 mm. The mortar used shall consist of one part of cement and 4 parts of approved of local sand. The joints shall be struck finished at the time of laying. The rate shall include for supply of all materials, scaffoldings, labour, tools and plants, etc. required for proper completion of the work.

The work shall be carried out in accordance with P.W.D. detailed specifications No. 35 of Part-I section 'A' (Buildings) in general. The rate shall include for rendering smooth of all exposed surface after removal forms and centering which shall be neat and properly smooth ended planks. No extra payment for the rendering plastering of surface of RCC shall be made. The moulds and centering of concrete shall be substantially and rigidly constructed true to shape and dimensions shown in drawings. The rate shall include for cleaning of mild steel bars of all rust, dust etc., their fixing in position, and binding the same, with 24 BMG wire.

For all R.C.C. works, stone grit 10 mm. to 12 mm. gauge or as specified in the BOQ and clean coarse sand will be used. The mix shall be in the proportion as given in the description of items or drawings.

The work shall be carried out in accordance with PWD detailed specifications No. 35 & 89 of Part-I section 'A' (Buildings). The rate of M.S. reinforcement for R.C.C. work shall include for cleaning of mild steel bars of grease, dust etc., cutting to the same and fabrication to required shape and size. The reinforcement shall be measured for end to end and no extra payment shall be made for hook, band, over lapping and wastage. The bars shall be bent cold. The over lapping shall be to a length not less than 45 times the diameters of the bars and all bars shall be hooked at each end.

All steel used in the different works shall be of tested quality and will be arranged by the contractor himself. The contractor shall furnish the test certification of the steel brought by him to the site in demand and will also bear the charges for the testing of steel brought to the site if desired by the Engineer. It shall be free from pitting, loose, rust or mild scales, oil or grease, adhering earth or other materials that may adhere the bond between the concrete and the steel.

The work shall be carried out as per P.W.D. detailed specifications Part-I section 'A' (Buildings) end as per conditions given in reference books/booklets under schedule. Only first class bricks confirming various specified test (s) should be used.

The rate shall include for the supply of C.I. fittings and appurtenances of approved quality and make at site of work and fixing the same as per direction of the Engineer-in-charge all complete, as per conditions of the contracts.

There may be certain other items of work which though not specifically mentioned or described here in above may be required to be executed for the due completion of the work under this contract. All such works shall be carried out as per relevant Jal Nigam or P.W.D. detailed specifications of Part-I and II and these specifications shall be deemed to have incorporated in this contract, read along with other clauses applicable under this contractor. Best quality paint or varnish for each class of work shall be used and the work shall be carried out according to P.W.D. detailed specification No. 69 & 70 part-I section 'A' (Buildings). The color and make shall be approved by Engineer-in-charge.

The contractor is advised quote their rates after working out their own quantities of work required to be done and quote their rates accordingly. The rates shall include for the supply and fixing of G.I. pipes specials of approved quality as per BIS specification. The rate shall also include for painting the exposed pipe.

Maxfalt will be filled in mid between R.C.C. roof mixed with coarse sand and saw dust after making the expansion joints by cutting the edges of slabs. The work shall comply with P.W.D. detailed specifications. White washing or color washing shall comply with

P.W.D. detailed specification no. 74 Part-I Schedule 'A' (Buildings) and as described in BOQ. The color shall be getting approved first from Engineer-in-charge.

This work shall be complying with Jal Nigam and P.W.D. detailed specifications and specified in BOQ to the satisfaction of Engineer I/C.
Semicircular P.C.C. drain shall be constructed as per type design. All the item of work in valued in construction shall be carried out as per P.W.D. detailed specification. The interior of drain shall be perfectly smooth with neat cement and shall be truly semicircular. Earthwork and Excavation

5.3.1 RELEVANT IS CODES

IS: 1200	:	Method of Measurement for Building Works
IS: 3764	:	Safety code for Excavation Work
IS: 3385	:	Code of practice for measurement of civil engineering works
IS: 2720	:	Part II - Determination of Moisture Content
	:	Part VII - Determination of Moisture content dry density relation using light compaction
	:	Part VIII - Determination of Moisture Content Dry Density using heavy compaction
	:	Part XXVIII - Determination of Dry Density of soils, in place, by the sand replacement method
	:	Part XXIX - Determination of Dry Density of soils, in place, by the core cutter method.

5.3.2 General The conditions/specifications laid down hereunder will hold

good whether the excavation is to be carried out over areas for leveling foundations of structures, trenches for pipes or cables or any other type of work which involves earth work like the leveling of forming/embankments etc. as per Uttarakhand Peyjal Nigam / Uttarakhand PWD specifications.

i) Earthwork in excavation includes site-cleaning activities like removal of shrubs, loose stones, rubbish of all kinds, interfering with the works and with complete removal of roots. ii) The products of the above clearing operations shall be removed from the site, dumped, stacked at a place or places, burnt or otherwise disposed of as directed by the Engineer-in-Charge within the compound. iii) A permanent base line and cross lines shall be established to serve as reference grid using MS plates, pegs, pins set in concrete or brick masonry pillars where they will be free from disturbances.

i) A permanent bench marks or marks as required necessary for the works connected to the nearest GTS benchmark shall be established for reference.

ii) Excavation shall be carried out in all types of soil like top soil, silt, sand, gravel, soft murrum, clay, kankar, hard materials like disintegrated rock shale which can be removed by picks, crowbars and shovels. Soil/earth may contain boulders. Loosening of rocks include the other methods of excavation other than blasting such as chiselling, wedging line drilling to avoid shattering of rocks. The Engineer-in-Charge shall decide what method shall be adopted for removal of the hardrock.

iv) Excavation, whose sides are required to be maintained at a steeper slope than the stable slopes, will be required to be properly shored and strutted failing which the contractor will be required to execute the work by open cutting by the approval of Engineer-in Charge.

v) Negligence on account of this leading to any mishap will be entirely the responsibility of the contractor.

5.4 Concrete And Allied Works

5.4.1 General

The quality of materials and method and control of manufacture and transportation of all concrete work irrespective of mix, whether reinforced or otherwise shall conform to the applicable portions of this specification. The Engineer-in-Charge shall have the right to inspect the source/s of material/s, the layout and operation of procurement and storage of materials, the concrete batching and mixing equipment, and the quality control system. Such an inspection shall be arranged and Engineer-in Charge's approval obtained, prior to starting of concrete work. However, this shall not relieve the contractor with any of his responsibilities and all the materials, which do not conform to the specifications, will be rejected.

The minimum wall thickness for all RCC wall shall be 225 mm thick. The liquid retaining structures will be in M30grade.

The Contractor will maintain all registers and formats for quantity qualitative and quantitative measures of all concrete works on daily basis of steel consumed and concreting done updated on daily basis.

5.4.2 APPLICABLECODES

The following specifications, standards and codes, including all official amendments/ revisions and other specifications & codes referred to therein to therein, should be considered a part of this specification. In all cases the latest issue/edition/revision shall apply. In case of discrepancy between this specification and those referred to herein this bid document, this specification shallgovern.

5.4.3 MATERIALS

IS:29	-	Specification for 33 grade ordinary Portland cement
IS:455	-	Specification for Portland slag cement.
IS:148	-	Specification for Portland cement.
IS: 8112	-	Specification for 43-grade ordinary Portland cement.
IS: 123	-	Specification for sulphate resisting Portland cement.
IS: 383	-	Specification for coarse and fine aggregates from natural sources for concrete.
IS: 432	-	Specification for mild steel and medium tensile steel **(Parts-I & II)** bars and hard-drawn steel wires for concrete reinforcement
IS: 1786	-	Specification for high strength deformed steel bars and wires for concrete reinforcement.
IS: 1566	-	Specification for hard-drawn steel wire fabric for **(Part-I)** concrete reinforcement.
IS: 9103	-	Specification for admixtures for concrete.
IS: 2645	-	Specification for integral cement waterproofing compounds.
IS: 4990	-	Specification for plywood for concrete shuttering work.

5.4.4 MATERIAL TESTING

IS: 4021	-	Methods of physical tests for hydraulic cement. **(Parts-1 to 13)**
IS: 4032	-	Method of chemical analysis of hydraulic cement.
IS: 650	-	Specification for standard sand for testing of cement.
IS: 2430	-	Methods for sampling of aggregates for concrete.
IS: 2386	-	Methods of test for aggregates for concrete. **(parts-I to VIII)**
IS: 3025	-	Methods of sampling and test (physical and chemical) water used in industry.
IS: 6925	-	Methods of test for determination of water-soluble chlorides in concrete admixtures.

5.4.5 MATERIALSSTORAGE

IS: 4082 - Recommendations on stacking and storing of construction materials at site.

5.4.6 CONCRETE MIXDESIGN

IS:10262- Recommended guidelines for concrete mix design. SP:23- Handbook on Concrete Mixes. (S &T)

5.4.7 CONCRETETESTING

IS: 1199	-	Method of sampling and analysis of concrete.
IS:516	-	Method of test for strength of concrete

IS: 9013	-	Method of making, curing and determining compressive strength of accelerated cured concrete test specimens.
IS: 8142	-	Method of test for determining setting time of concrete by penetration resistance.
IS: 9284	-	Method of test for abrasion resistance of concrete.
IS: 2770	-	Methods of testing bond in reinforced concrete.

5.4.8 EQUIPMENT

IS: 1791	-	Specification for batch type concrete mixers.
IS: 2438	-	Specification for roller pan mixer.
IS: 4925	-	Specification for concrete batching and mixing plant.
IS: 5892	-	Specification for concrete transit mixer and agitator.
IS: 7242	-	Specification for concrete spreaders.
IS: 2505	-	General Requirements for concrete vibrators: Immersion type.
IS: 2506	-	General Requirements for screed board concrete vibrators.
IS: 2514	-	Specification for concrete vibrating tables.
IS: 3366	-	Specification for pan vibrators.
IS: 4656	-	Specification for form vibrators for concrete.
IS: 11993	-	Code of practice for use of screed board concrete vibrators.
IS: 7251	-	Specification for concrete finishers.
IS: 2722	-	Specification for portable swing weigh batchers for concrete(single and double bucket type).
IS: 2750	-	Specification for steel scaffoldings.

5.4.9 CODES OFPRACTICE

IS: 456	-	Code of practice for plain and reinforced concrete.
IS: 457	-	Code of practice for general construction of plain and Reinforced concrete for dams and other massive structures.
IS:3370	-	Code of practice for concrete structures for storage of liquids.(parts-I to IV)
IS: 3935	-	Code of practice for composite construction.
IS: 2204	-	Code of practice for construction of reinforced concrete shell roof.
IS: 2210	-	Criteria for the design of reinforced concrete shell structures and folded plates.
IS: 2502	-	Code of practice for bending and fixing of bars for concrete Reinforcement.
IS: 5525	-	Recommendation for detailing of reinforcement in reinforced Concrete works.

IS: 2751	-	Code of practice for welding of mild steel plain and deformed Bars used for reinforced concrete construction.
IS: 9417	-	Specification for welding cold worked bars for reinforced concrete construction.
IS: 3558	-	Code of practice for use of immersion vibrators for consolidating concrete.
IS: 3414	-	Code of practice for design and installation of joints in building.
IS: 4326	-	Code of practice for earthquake resistant construction of building.
IS:4014	-	Code of practice for steel tubular scaffolding.(parts-I & II)
IS: 2571	-	Code of practice for laying in-situ cement concrete flooring.
IS: 7861	-	Code of practice for extreme weather concreting. Part-I: Recommended practice for hot weather concreting. Part-II: Recommended practice for cold weather concreting.
IS: 13920	-	Ductile Detailing of Reinforced Concrete Structure subjected to 1993 seismic forces.
SP-16	-	Design Aids for Reinforcement Concrete to IS:456-1978 (S&T) -1980
SP-24	-	Explanatory Handbook on IS: 456-1978
SP-34	-	Handbook on Concrete Reinforcement and Detailing(S&T) - 1987

5.4.10 CONSTRUCTIONSAFETY

IS:3696	-	Safety code for scaffolds and ladders.(Parts-I & II)
IS:7969	-	Safety code for handling and storage of building materials
IS: 8989	-	Safety code for erection of concrete framed structures.

5.4.11 MEASUREMENT

IS: 1200	-	Method of measurement of building and engineering works.
IS: 3385	-	Code of practice for measurement of civil engineering works.

5.4.12 MATERIALS FOR STANDARD CONCRETE

The ingredients to be used in the manufacture of concrete shall consist solely of Ordinary Portland Cement (IS:8112) or Sulphate

Resistant Cement clean sand, natural course aggregate, clean water, and admixtures.

The contractor will have to make own arrangements for procuring cement and steel. Cement remaining in bulk storage at the mill, prior to shipment for more than 6 months or cement in bags in local storage in the hands of vendor for more than 3 months after completion of tests may be retested before use and may be rejected if it fails to conform to any of the requirement of IS269-1976.

The Contractor will have to make his own arrangements for transport from supplier godown and storage of adequate quantity of cement. Contractor will construct cement godown. in batches of 10x10, which will provide complete protection from dampness, contamination and minimize caking and false set. Cement bags shall be stored in a dry enclosed shed (storage under tarpaulins will not be permitted), well away from the outer walls and insulated from the floor to avoid contact with moisture from the ground and so arranged as to provide ready access. Damaged or reclaimed or partly set cement will not be permitted to be used and shall be removed from the site. The storage bins and storage arrangement shall be approved by the Engineer-in-Charge. Consignments of cement shall be stored as received and shall be consumed in the order of their delivery. Stacking of cement shall be done as per IS and in such a way that first come cement shall be used first.

Cement held in storage for a period of ninety (90) days or longer shall be tested. Should at any time the Engineer-in-Charge have reasons to consider that any cement is defective, then irrespective of its origin, date of manufacture and or manufacturer's test certificate, such cement shall be tested immediately at the Contractor's cost at an approved laboratory and until the results of such tests are found satisfactory, it shall not be used in any work. Testing certificates for each batch of cement should be submitted by the contractor to the Engineer-in-Charge, before starting the concreting work. The Contractor shall not be entitled to any claim of any nature on this account.

5.4.13 Aggregates

i) General

"Aggregate" in general designates both fine and coarse inert materials used in the manufacture of concrete (Vide BIS 456 &BIS 383) and confirming to tests as per BIS 2386 (Part I to VI) "Coarse Aggregate" is aggregate most of which is retained when passed through on 4.75 mm BIS sieve.

Aggregates shall consist of natural sands, stone (crushed or uncrushed) and gravel from a source known to produce satisfactory aggregate for concrete and shall be chemically inert, non-flaky, strong, hard, durable against weathering, of limited porosity and free from deleterious materials that may cause corrosion of the reinforcement or may impair the strength and or durability of concrete. The grading of aggregates shall be such as to produce a dense concrete of specified strength and consistency that will work readily into position without segregation and shall be based on the "mix design" and preliminary tests on concrete specified later.

ii) Storage of aggregates

All coarse and fine aggregates shall be stacked separately in stock piles in the material yard near the work site in bins properly constructed to avoid inter mixing of different aggregates. Contamination with foreign material and earth during storage and while heaping the materials shall be avoided. The aggregates must be of specified quality not only at the time of receiving at site but more so at the time of loading into mixer. Rakers shall be piled in layers not exceeding 1.20 m in height to prevent coning or segregation. Each layer shall cover the entire area of stockpile before succeeding layers are started. Aggregates that have become segregated shall be rejected.

iii) Specific Gravity

Aggregates having a specific gravity below 2.4 (saturated surface dry basis) shall not be used.

5.4.14 FINEAGGREGATE

Fine aggregate shall consist of natural or crushed sand conforming to BIS 383 confirming to tests as per BIS 2386 part I to VI. The sand shall be clean, sharp, hard, strong and durable and shall be free from dust, vegetable substances, adherent coating, clay, alkali, organic matter, mica, salt, or other deleterious substances, which can be injurious to the setting qualities/strength/durability of concrete.
Screening and Washing: Sand shall be prepared for use by such screening or washing, or both, as necessary, to remove all objectionable foreign matter while separating the sand grains to the required size fraction.
Foreign Material limitations: The percentage deleterious substances in sand delivered to the mixer shall not exceed the following:

Table 2: Foreign Material Limitations in Fine Aggregate

Sr. No.	Foreign material	Percentage by weight	
		Uncrushed	Crushed
1	Material finer than 75 micron BIS sieve	3.0	15.0
2	Shale	1.0	-
3	Coal & Lignite	1.0	1.0
4	Clay Lumps	-	1.0
	Total	5.0	17.0

Gradation: Unless otherwise directed or approved by the Engineer-in- Charge, the grading of sand shall be within the limits indicated hereunder:

Table 3: Grading of Sand for Fine Aggregate

BIS :Sieve Designation	Grading Zone I	Grading Zone II	Grading Zone III	Grading Zone IV
10 mm	100	100	100	100
4.75 mm	99-100	90-100	90-100	95-100
2.36 mm	60-95	75-100	85-100	95-100
1.18 mm	30-70	55-90	75-100	90-100
600 microns	15-34	35-59	60-79	80-100
300 microns	5-20	8-30	12-40	15-50
150 microns	0-10	0-10	0-10	0-15

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

5.4.15 Fineness Modulus

The sand shall have a fineness modulus of not less than 2.0 or more than 3.5. The fineness modulus is determined by adding the cumulative percentages retained on the following IS sieve sizes (4.75 mm, 2.36 mm, 1.18 mm, 600 microns and 150 microns) and dividing the sum by100.

5.4.16 COARSEAGGREGATE

Coarse aggregate for concrete, except as noted above, shall conform to IS 383 & IS 2386. This shall consist of crushed stone and shall be clean and free from elongated, flaky or laminated pieces, adhering coatings, clay lumps, coal residue, clinkers, slag, alkali, mica, organic matter or other deleterious matter.

Screening and Washing: Crushed rock shall be screened and/ or washed for the removal of dirt or dust coating, if so requested by the Engineer-in Charge.

5.4.17 Grading

i) Coarse aggregate shall be either in single size or graded, in both cases the grading shall be within the following limits:

BIS Sieve Size(mm)	**Percentage passing for single sized aggregate of normal size**					**Percentage Passing For Graded Aggregate Of Normal Size**			
	40 mm	**20 mm**	**16 mm**	**12.5 mm**	**10 mm**	**40 mm**	**20 mm**	**16 mm**	**12.5 mm**
63	100	-	-	-	-	100	-	-	-
40	85-100	100	-	-	-	95-100	-	-	-
20	0-20	85-100	100	-	-	30-70	95-100	100	-
16	-	-	85-100	100	-	-	-	90-100	-
12.5	-	-	-	85-100	100	-	-	-	90-100
10	0-5	0-20	0-30	0-45	85-100	10-35	25-35	30-70	40-85
4.75	-	0-5	0-5	0-10	0-20	0-5	0-10	0-10	0-10
2.36	-	-	-	-	0-5	-	-	-	-

ii) The pieces shall be angular in shape and shall have granular or crystalline surfaces. Friable, flaky and laminated pieces, mica and shale, if present, shall be only within tolerance limits which will not affect adversely the strength and or durability of

concrete. The maximum size of coarse aggregate shall be 40 mm for M-7.5 and M-10 and 20mm for M-15 to M-30 concrete, or as directed by the Engineer- in-charge or specified. The maximum size of coarse aggregate shall be the maximum size specified above but in no case greater than 1/4th of the minimum thickness of the member, provided that the concrete can be placed without difficulty so as to surround all reinforcement thoroughly and fill the corners of the form. For plain concrete the maximum size of aggregate shall be of 40 mm. For heavily reinforced concrete members, the nominal maximum size of the aggregate shall be 5 mm less than the minimum clear distance between the reinforcing main bars or 5 mm less than the minimum cover to reinforcement whichever is smaller.

5.4.18 Foreign material limitations

The percentage of deleterious materials in the aggregate delivered to the mixer shall not exceed the following:

Table 4 : Foreign Material Limitations in Coarse Aggregate

Sr. No.	Foreign Material	Percentage by Weight	
		Uncrushed	Crushed
1	Material finer than 75 micron BIS Sieve	3.0	3.0
2	Coal and lignite	1.0	1.0
3	Clay Lumps	1.0	1.0
4	Soft Fragments	3.0	-
	Total	**8.0**	**5.0**

5.4.19 Water

Water used for washing, mixing and curing shall be free from injurious amounts of deleterious materials. Potable water is generally satisfactory for mixing and curing concrete. Physical and chemical analysis of the water should be submitted to the Engineer- in-charge, before starting the work.

In case of doubt, the suitability of water for making concrete shall be ascertained by the compressive strength and initial setting time test specified in BIS 456. The sample of water taken for testing shall be typical of the water proposed to be used for concreting, due account being paid to seasonal variation. The sample shall not receive any treatment before testing other than that envisaged in the regular supply of water proposed for use in concrete. The sample shall be stored in a clean container previously rinsed out with similar water.

Average 28 days compressive strength of at least three 15 cm concrete cubes prepared with water proposed to be used shall not be less than 90% of the average strength of three similar concrete cubes prepared with distilled water. The cubes shall be prepared, cured and tested in accordance with the requirements of BIS 516.

The initial setting time of test block must be made with the appropriate test cement and the water proposed to be used. It shall not be less than 30 minutes and shall not differ by more than +/-30 minutes from the initial setting time of control test block prepared with the appropriate test cement and distilled water. The test block shall be prepared and tested in accordance with the requirements of BIS4031.

Where water can be shown to contain an excess of acid, alkali, sugar or salt, Engineer-in-charge may refuse to permit its use. As a guide, the following concentrations represent the maximum permissible values. To neutralize 200 ml sample of water, using phenolphthalein as indicator, it should not require more than 2 ml of 0.1 normal NaOH. The details of test shall be as given in BIS3025.

To neutralize 200 ml sample of water, using methyl orange as an indicator, it should not require more than 10 ml of 0.1 Normal HCl. The details of test shall be as given in BIS 3025.

Percentage of solids, when tested in accordance with the method indicated below shall not exceed the following:

Solids	**Percent**	**Method of test**
Ref. to col. no in IS:3025) Organic		
(organic solid = total solids minus ignited residue)	0.02	10 and 11
Inorganic	0.03	11(ignited residue)
Sulphates (as So4)	0.05	20
Alkali Chlorides (as Cl)	0.20	24
Suspended matter	0.20	12
The pH value of water shall not generally be less than 6.		

5.4.20 Steel and Aluminum Members Encased in Concrete

Structural steel and aluminum ladders etc. to be encased in concrete shall be without paint. Primer should be used for encasing purpose. The encasing shall be done in concrete with 10 mm, maximum size aggregate and works cube strength not less than 150 kg/sq.cm. at 28 days unless otherwise specified. The member shall be wrapped with galvanized aluminum wire mesh of adequate size. The galvanized aluminum wire mesh shall be kept 20 mm from the edge or surface of the member and shall be held in position securely. The member will have a minimum cover of 50 mm unless otherwise indicated in the drawings. Where the clear cover is more than 75 mm, concrete with 20 mm coarse aggregate can be used.

5.4.21 Controlled Concrete

All concrete in the works shall be “Controlled Concrete” as defined in IS: 456 except for M-7.5 and M-10 for which normal mix concrete shall be used. Whether reinforced or otherwise, all concrete works to be carried out under this specification shall be divided into the following classifications:

Minimum Compressive Strength of 15 cm cubes at 7 days and 28 days after mixing, conducted in accordance with IS: 516.

Any operation of concrete done at atmospheric temperature above 40 degree C or where the temperature of concrete at the time of placement is expected to be beyond 40 degree C may be categorize as hot weather concreting and should be confined to the requirement of IS 7861(Part-I) 1975 and SP-23 (S&T)-1982.

Class	Preliminary Test N/mm^2		Works Test N/mm^2		Max. Size Of Aggregate mm	Locations For Use
	At 7 Days	At 28 days	At 7 days	At 28 days		
M40	33.5	50.0	27.0	40.0	20	As indicated in the specifications or as required
M35	30.0	44.0	23.5	35.0	20	
M30	25.0	38.0	20.0	30.0	40 or 20	
M25	22.0	32.0	17.0	25.0	40 or 20	
M20	17.5	26.0	13.5	20.0	40 or 20	
M15	13.5	20.0	10.0	15.0	40 or 20	

Note: It shall be very clearly understood that whenever the grade of concrete such as M-20, etc. is specified it shall be contractor's responsibility to ensure the minimum crushing strength stipulated for the respective grade of concrete is obtained at works.

5.4.20 Mix Design

5.4.20.1. General

This is essential for investigating the grading of aggregates, water cement ratio, workability and the quality of cement required to give preliminary and works cubes of the minimum strength specified. The proportions of the mix shall be determined by weight. Adjustment of aggregate proportions due to moisture present in the aggregate shall be made. Determination of mix proportions shall be carried out according to "Recommended guidelines for Concrete Mix Design" conforming to IS: 10262.

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

While fixing the value for water/cement ratio for preliminary mixes, assistance may be derived from the graph (Appendix A, BIS 456 showing the relationship between the 28 day compressive strengths of concrete mixes with different water/cement ratios and the 7-day compressive strength of cement tested in accordance with IS: 269.

5.4.20.2. Preliminary Tests

Test specimens shall be prepared with at-least two different water/cement ratios for each class of concrete, consistent with work ability required for the nature of the work. The materials and proportions used in making preliminary tests shall be similar in all respects to those to be actually employed in the works as the object of these tests is to determine the properties of cement, aggregates and water necessary to produce concrete of required

consistency and to give the specified strength, it will be contractor's sole responsibility to carry out these tests and he shall therefore furnish to Engineer-in Charge a statement of proportions proposed to be used for the various concrete mixes. For preliminary tests, the following procedure shall be followed.

Materials shall be brought to the room temperature and all materials shall be in a dry condition. The quantities of water cement and aggregates for each batch shall be determined by weight to an accuracy of 1 part in 100 parts.

Mixing concrete shall be done by hand (for small quantities, as directed by Engineer-in-Charge) or in a small batch mixer as per IS: 516 in such a manner as to avoid loss of water. The cement and fine aggregate shall first be mixed dry until the mixture is uniform in color. The coarse aggregate shall then be added, mixed and water added and the whole batch mixed thoroughly for a period of not less than two minutes until the resulting concrete is uniform in appearance. Each batch of concrete shall be such a size as to leave about 10% excess concrete, after moulding the desired number of test specimens.

The consistency of each batch of concrete shall be measured immediately after mixing, by the slump test in accordance with IS:1199. If in the slump test, care is taken to ensure that no water or other material is lost, the material used for the slump test may be re-mixed with the remainder of the concrete for making the specimen test cubes. The period of re-mixing shall be as short as possible yet sufficient to produce a homogeneous mass.

The samples for compression tests of concrete shall be made as per IS: 516 on 15 cm cubes. Each mould shall be provided with a metal base plate having a plate surface so as to support the mould during filling without leakage. The base plate shall be preferably attached to the mould by springs or screws. The parts of the mould when assembled shall be positively and rigidly held together. Before placing concrete, the mould and base plate

Shall be cleaned and oiled. The dimensions and internal faces of the mould shall be accurate within the following limits. Height and distance between the opposite faces of the mould shall be of specified size +0.2 mm. The angle between the adjacent internal faces and between internal faces and top and bottom faces of mould shall be 90-degree +0.5 degree. The interior faces of the mould shall be plane surfaces with a permissible variation of 0.03 mm.

Concrete test cubes shall be molded by placing fresh concrete in the mould and compacted as specified in IS 516. Curing shall be as specified in IS 516. The cubes shall be kept in moist air of at least 90% relative humidity at a temperature of 27 degree C + 2 degree C for 24 hours +2 hours from the time of adding water to the dry ingredients. Thereafter they shall be removed from the moulds and kept immersed in clean, fresh water and kept at 27 degree C +2 degree C temperature until required for test. Curing water shall be renewed every seven days. A record of maximum and minimum temperatures at the place of storage of the cubes shall be maintained during the period they remain in storage.

The strength shall be determined based on not less than five cube test specimens for each age and each water cement ratio. All these laboratory test results shall be tabulated and furnished to the Engineer in-Charge. The test results shall be accepted by the Engineer-in Charge if the average compressive strengths of the specimens tested is not less than the compressive strength specified for the age at which specimens are tested subject to the

condition that only one out of the five consecutive tests may give a value less than the specified strength for that age. The Engineer-in-Charge may direct the contractor to repeat the tests if the results are not satisfactory and also make such changes as he considers necessary to meet the requirements specified Proportioning, Consistency, Batching and Mixing of Concrete.

The determination of the water cement ratio and proportion of aggregates to obtain the required strength shall be made from preliminary tests by designing the concrete mix. Controlled concrete shall be used on all concrete work complying with all the requirements of IS: 456. Cube tests shall be carried out by the contractor on the trial mixes before the actual concreting operation starts. Based on the strength of the concrete mix sanction for the use has to be obtained from Engineer-in-Charge. If during the execution of the works it is found necessary to revise the mix because of the cube tests showing lower strengths than the required one due to inconsistency of quality of material or otherwise, The Engineer-in-Charge shall ask for fresh trial mixes to be made by the contractor. No claim to alter the rates of concrete work shall be entertained due to such change in mix variations, as it is the contractor's responsibility to produce the concrete of the required grade.

Great care shall be exercised when mixing the actual works concrete using the proportions of the selected trial mix. The final concrete mix shall have the same proportions and same source of cement, fine and coarse aggregates and water as that of the approved selected mix.

A reasonable number of bags should be weighed separately to check the Net weight, where the weight of cement is determined by accepting the manufacturer's weight per bag at the site. Proper control of mixing water is deemed to be of paramount importance. If mixers with automatic addition of water are used, water should be either measured by volume in calibrated buckets, tins or weighed. All measuring equipment shall be maintained in a clean serviceable condition and their accuracy periodically checked and certified and the Engineer-in Charge's approval obtained.

The Engineer-in-Charge may require the contractor to carry out moisture content tests in both fine and coarse aggregates. The amount of the added water shall then be adjusted to compensate for any observed variations in the moisture contents. BIS: 2386 shall be referred to for determination of moisture content.

No substitution in material, used on the work or alteration in the established proportions shall be made without additional tests to show that the quality and strength of concrete are satisfactory. No alterations shall be permitted without the prior sanction of the Engineer-in-Charge.

5.4.20.3. Mixing of Concrete

The mixing of concrete shall be strictly carried out in an approved type of mechanical Concrete mixer. The mixing equipment shall be capable of combining the aggregates. Cement and water within the specified time into a thoroughly mixed and uniform mass, and of discharging the mixture without segregation. The entire batch shall be discharged before recharging. Mixing periods shall be measured from the time when all of the solid materials are in the mixing drum, provided that all of the mixing water shall be introduced before one fourth of the mixing time has elapsed. The mixing time in no case shall be less

than two minutes. The mixer speed shall not be less than 14 nor more than 20 revolutions per minute.

Mixing shall be continued until there is a uniform distribution of the materials and the mass is uniform in color and consistency. Hand mixing of concrete shall not be permitted at all.

For quantities less than 1 cum of concrete, hand mixing may be permitted at the discretion of the Engineer-in-Charge with 10% excess cement quantity.

5.4.20.4. Grade of Concrete

The different grades of concrete specified shall conform to the strengths as required by IS: 456-1987. Standard deviation shall be calculated as stated in 14.5 of IS: 456-1978. The acceptable criteria for concrete shall be as stated in clause 15 of IS: 456 - 1978. The assumed standard deviations as given in table 6 of IS: 456-1978 has to be followed and are given here under. However, the minimum cement content shall be as per *Table no. 7: Minimum Cement Content in Concrete* in this tender document.

Table 5: Grade of Concrete

Grade of Concrete	Assumed Standard Deviation N/sq.mm
M 10	2.3
M 15	3.5
M 20	4.6
Grade of Concrete	**Assumed Standard Deviation N/sq.mm**
M 25	5.3

In order to get a quick idea of quality of concrete the optional tests are conducted as stipulated in 14.1.1 of IS: 456-1978 and the results are analyzed according to table 5 on page 41 of IS: 456-1978.

5.4.20.5. Controlled Concrete

Controlled concrete shall be used on all concreting works except where specified otherwise the mix proportions for all grades of concrete shall be designed to obtain strengths corresponding to the values specified in table below for respective grades of concrete.

Table 6: Compressive Strengths at 28 days

Grade	Specified Characteristic Compressive Strength at 28 days (N/sq.mm)
M15	15
M20	20
M25	25
M30	30

The maximum Water : Cement ratio for all controlled concrete works shall be as specified in IS: 456-1978 as Preliminary tests as specified in the BIS code and required by the Engineer-in- charge shall be carried out sufficiently ahead of the actual commencement of the work with different grades of concrete made from representative samples of aggregates and cement expected to be used on the job to ascertain the ratios by weight of cement of total quantity of fine and coarse aggregates and the water cement ratio required to produce a concrete of specified strength and desired workability.

The minimum cement content for each grade of concrete shall be as per table below.

Table 7: Minimum Cement Content in Concrete

Grade of Concrete	Minimum Cement Content in Concrete (kg/cum of finished Concrete)
M 15	**300**
M 20	**330**
M 25	**360**
M 30	**400**

At least 4 (four) trial batches are to be made and 7 test cubes should be taken for each batch noting the slump on each mix. These cubes shall then be properly cured and two cubes from each mix shall be tested in a testing laboratory approved by the Engineer-in-Charge at 7 days and others at 28 days for obtaining the ultimate compressive strength. The test reports shall be submitted to the Engineer in charge. The cost of mix design and testing shall be borne by the contractor. On the basis of the preliminary test reports for trial mix, a proportion of mix by weight and water cement ratio will be approved by the Engineer-in-Charge, which will be expected to give the required strength. Consistency and workability and the proportions so decided for different grades of concrete shall be adhered to during all concreting operations. If however at any time the Engineer-in-Charge feels that the quality of material, being used has been changed from those used for preliminary mix design, the contractor shall have to run similar trial mixes to ascertain the mix proportions and consistency.

The mix once approved must not be varied without prior approval of the Engineer-in-Charge. However should the contractor anticipate any change in the quality of future supply of materials than that used for preliminary mix design, he shall inform the same to the Engineer-in-Charge and bring fresh samples sufficiently ahead to carry out fresh trial mixes. The Engineer-in-Charge shall have access to all places and laboratory where design mix is prepared. Design mix will indicate by means of graphs and curves etc. the extent of variation in the grading of aggregates which can be allowed.

In designing the mix proportions of concrete, the quantity of both cement and aggregate shall be determined by weight. All measuring equipment shall be maintained in clean and serviceable condition and their accuracy periodically checked.

To keep the water cement ratio to the designed value, allowance shall be made for the moisture contents in both fine and course aggregates and determination of the same shall be made as frequently as directed by the Engineer-in-Charge.

The determination of moisture contents shall be according to IS: 2386 (Part III). Absorption of water by dry aggregates shall not be more than 5%.

Strength Requirements

Where ordinary Portland cement conforming to IS: 269 or Portland blast furnace slag cement conforming to IS: 455 is used the compressive strength requirements for various grades of concrete shall be as shown in table below. Where rapid hardening Portland cement is used the 28 days compressive strength requirements specified in Table- hereunder shall be met in 7 days. The strength requirements specified in table shall apply to both controlled concrete and ordinary concrete.

Strength Requirements of Concrete

Grade of Minimum Compressive Strength Concrete in Concrete Accordance with IS: 516 (In kg/cm)

As per IS: 456-1978

For 15 cm cube specimens	**at 7 days Work Test**	**Preliminary**	**at 28 days Work Test**
M 15	100	200	150
M 20	135	260	200
M 25	170	320	250
M 30	200	380	300

Other requirements of concrete strength as may be desired by the Engineer-in-Charge shall be in accordance with Indian Standard IS: 456 (latest revision). The acceptance of strength of concrete shall be as per clause 5.4 “Sample size and Acceptance Criteria” of IS: 456 (latest revision) subject to stipulation and/or modifications stated elsewhere in this specification if any.

Concrete work found unacceptable shall have to be dismantled and replaced to the satisfaction of the Engineer-in-Charge by the Contractor free of cost to the Owner. No payment will be made for the dismantled concrete, the relevant formwork and reinforcement, embedded mixtures etc. wasted in the dismantled portion shall be made. In the course of dismantling if any damage is done to the embedded items or adjacent structures, the same shall also be made good free of charge by the contractor to the satisfaction of the Engineer in charge. If the water quantity has to be increased in special cases, cement also has to be increased proportionately to keep the ratio of water to cement same as adopted in trial mix design for each grade of concrete.

5.4.20.6. Workability

The workability of concrete shall be checked at frequent intervals by slump test. Where facilities exist and if required by the Engineer-in Charge, alternatively the compacting factor test in accordance with IS: 1199 shall be carried out. The degree of workability necessary to allow the concrete to be well consolidated and to be worked into the corners of form work and round the reinforcement to give the required surface finish shall depend on the type and nature of the structure and shall be based on experience and tests. The limits of consistency for structures are as specified in the table below:

Table 8: Limits of Consistency

Placing Conditions	Degree of Workability	Values of Workability
Concreting of shallow Sections with vibration	Very low	20-10 seconds Veebee time or 0.75-0.80 compacting factor
Concreting of lightly Reinforced sections With vibration	Low	10-5 seconds or0.80-0.85 compacting factor
Concreting of lightly Reinforced sections Without Vibration or Heavily reinforced Section with Vibration	Medium	5-2 seconds Veebee time or 0.85-0.92 compacting factor or 25-75mm slump for 20 mm Aggregate
Concreting of heavily Reinforced sections compacting Withoutvibration factor	High	Above 0.92 compacting factor or 75-125 mm slumps for 20 mm aggregate

5.4.20.7. Workmanship

All workmanship shall be according to the latest relevant standards. Before starting a pour the contractor shall obtain the approval of the Engineer-in-Charge and all other concerned department including safety dept, in a "Pour Card" maintained for this purpose. He shall obtain complete instructions about the material and proportion to be used, slump, workability of water per unit of cement, number of test cubes to be taken, finishing to be done and any admixture to be added etc.

5.4.20.8. Sampling And Testing Concrete In The Field

Sampling and Testing of Concrete shall conform to IS: 456 2000.

a) Facilities required for sampling materials and concrete including whether proof buildings to house the facilities in the field, shall be provided by the contractor at no extra cost. The following equipment with operator shall be made available in serviceable conditions.

(i)	Concrete cube-testing machine suitable for 15 cm cubes of 100 tones capacity with proving calibration ring	1 no.
(ii)	Cast iron cube moulds 15 cm size	12 nos.

(iii)	Slump cone complete with tamping rod	1 set
(iv)	Laboratory balance to weigh upto5 kg with sensitivity of 10 gm	1 no.
(v)	BIS sieves for coarse and fine aggregates	1 set
(vi)	Set of measures from 5 litres to 0.1 litre	1 set
(vii)	Electric oven with thermostatupto120 C	1 no.
(viii)	Flakiness gauge	1 no.
(ix)	Elongation index gauge	1 no.
(x)	Sedimentation pipette	1 no.
(xi)	Calibrated glass jar 1.0 litre capacity	2 nos.
(xii)	Glass flasks and metal containers	As required
(xiii)	Chemical reagents like sodium hydroxide, tannic acid, litmus paper etc. -	As required
(xiv)	Laboratory balance of 2 kg capacity and sensitivity of 1 gm -	1 no.
(xv)	Weighing Machine for cement bags of 6 Nos	2 no.
(xvi)	Vernier Calipers	As Required.
(xvii)	Thermometer for concrete	1 no.

No concrete of any kind may be placed until the field concrete testing laboratory as specified is provided to the satisfaction of the Engineer. The contractor shall notify the Engineer in advance of all concrete and concrete material testing as provided in the clause to provide the Engineer/his representative with an opportunity to witness all prescribed tests.

At least 6 test cubes of each class of concrete shall be made of every 50cum concrete or part thereof or from different batches as directed by Engineer-in-Charge. Such samples shall be drawn on each day for each type of concrete. Of each set of 6 cubes, three shall be tested at 7 days age and three at 28 days age. The cubes must be casted from various batches to arrive at an average strength. The laboratory test results shall be tabulated and furnished to the Engineer. The Engineer will pass the concrete if average strength of the specimens tested is not less than the strength specified, subject to the condition that only one out of three consecutive tests may give a value less than the specified strength but this shall not be less than 90% of the specified strength. Consistency: Slump tests shall be carried out as often as requested by the Engineer and invariably from the same batch of concrete from which the test cubes are made. Slump tests shall be done immediately after sampling.

5.4.20.9. CONCRETE TESTS

The Engineer-in-Charge, may order tests to be carried out on cement, sand, coarse aggregate, water in accordance with the relevant Indian standards.

Tests on Cement shall include:
Fineness test

Test for normal consistency Test for setting time
Test for soundness Test for tensile strength

Test for compressive strength
Test for heat of hydration (by experiment and by calculations) in accordance with BIS 269

Tests on Sand shall include:
Sieve test
Test for organic impurities
Decantation test for determining clay and silt content Specific gravity test
Test for unit weight and bulk age factor
Test for sieve analysis and fineness modulus

Tests on Coarse Aggregate shall include:
Sieve analysis
Specific gravity and unit weight of dry, loose and rodded aggregate
Soundness and alkali aggregate reactivity Petrography examination
Deleterious materials and organic impurities Test for aggregate crushing value

Any or all these tests would normally be ordered to be carried out only if the Engineer feels the materials are not obtained and shall be performed by the contractor at a test laboratory approved by Engineer-in charge. The contractor shall bear the charges of these optional tests.
Concrete not made to the requirements of specification in all respects may be rejected by the Engineer-in-Charge in which case it shall be removed and reconstructed entirely at the expense of the contractor.

5.4.23.8.1. Load Test on Members or Any Other Tests

In the event of any work being suspected of material or workmanship or both, the Engineer-in-charge requiring its removal and reconstruction may order, or the contractor may request that it should be load tested in accordance with the following provisions. The test load shall be 125% of the maximum superimposed load for which the structure was designed. Such test load shall not be applied before 56 days after the effective hardening of concrete. During the test, struts strong enough to take the whole load shall be placed in position leaving a gap under the members. The test load shall be maintained for 24 hours before removal.
If within 24 hours of the removal of the load, the structure does not show a recovery of at least 75% of the maximum deflection shown during the 24 hours under load, the test loading shall be repeated after a lapse of at least 72 hours. The structure shall be considered to have failed to pass the test if the recovery after the second test is not at least 75% of the maximum deflection shown during the second test. If the structure is certified as failed by the Engineer in-Charge, the cost of all the new construction and the load tests shall be borne by the contractor.

Any other tests, e.g. taking out in an approved manner concrete cores, examination and tests on such cores removed from such parts of the structure as directed by the Engineer-in-Charge, sonic testing etc. shall be carried out by the contractor, if so directed, at no extra cost.

5.4.23.8.2. Unsatisfactory tests

Should the results of any test prove unsatisfactory, or the structure shows signs of weakness, undue deflection or faulty construction, the contractor shall remove and rebuild the member or members involved or carry out such other remedial measures as may be required by the Engineer-in Charge.

5.4.23.8.3. Admixtures 5.4.23.9.1. General

Admixtures may be used in concrete where required, only with the approval of the Engineer-in-Charge. However it should be seen that, with the passage of time, neither the compressive strength nor its durability is reduced. Calcium chloride shall not be used for accelerating set of the cement for any concrete containing reinforcement or embedded steel parts. When calcium chloride is permitted to be used, such as in mass concrete works, it shall be dissolved in water and added to the mixing water in an amount not to exceed 1.5% of the weight of the cement in each batch of concrete. When admixtures are used, the designed concrete mix shall be corrected accordingly. Admixtures shall be used as per manufacturer's instruction and in the manner and with the control specified by the Engineer-in- Charge.

5.4.23.8.4. Air Entraining Agents

Neutralized Vinson resin or other approved air in the concrete mix agents shall conform to the requirements of ASTM standard 6.260; Air Entraining Admixtures for Concrete. The recommended total air content of the concrete is 4% + 1%. The method of measuring air content shall be as per IS: 1199.

5.4.23.8.5. Water Reducing Admixtures

Water reducing lignosulfonate admixture may be added in quantities approved by the Engineer-in-Charge. The admixtures shall be added in the form of a solution.

5.4.23.8.6. Retarding Admixtures

Retarding agents may be added to the concrete mix in quantities approved by the Engineer-in-Charge.

5.4.23.8.7. Water Proofing Agent

Water proofing agents shall conform to IS: 2645.

5.4.23.8.8. Other Admixtures

The Engineer-in-Charge may at his discretion allow the contractor to use any other admixture in the concrete.

5.4.23.8.9. Preparation Prior to Concrete Placement, Final Inspection and Approval

Before the concrete is actually placed in position, the insides of the formwork shall be inspected to see that they have been cleaned and oiled. Temporary openings shall be provided to facilitate inspection, especially at bottoms of columns and wall forms, to permit removal of sawdust, wood shavings, binding wire, dirt etc. Openings shall be placed or holes drilled so that these materials and water can be removed easily. Such openings/holes shall be suitably plugged later. The various agencies shall be permitted ample time to install drainage and plumbing lines, floor and trench drains, conduits, hangers, anchors, inserts, sleeves, bolts, frames and other miscellaneous embedment to be cast in the concrete as specified or required or as is necessary for the proper execution of the work as specified in the drawings.

All embedded parts, inserts, etc. supplied by the contractor shall be correctly positioned and securely held in the forms to prevent displacement during depositing and vibrating of concrete.

All anchor bolts shall be positioned and kept in place with the help of properly manufactured templates unless specifically waived in writing by the Engineer-in-Charge.

Slots, openings, holes, pockets etc. shall be provided in the concrete work in the position specified in drawing or required or as directed by the Engineer-in-Charge.

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

Prior to concrete placement, all work shall be inspected and approved by the Engineer-in-Charge and if found unsatisfactory, concrete shall not be poured until after all defects have been corrected.

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

5.4.23.8.10. Rain or wash water

No concrete shall be placed in wet weather or on a water- covered surface. Any concrete that has been washed by heavy rains shall be entirely removed, if there is any sign of cement and sand having been washed away from the concrete mixture. To guard against damage, which may be caused by rains, the works shall be covered with tarpaulins immediately after the concrete has been placed and compacted before leaving the work unattended. Any water accumulating on the surface of the newly placed concrete shall be removed by approved means and no further concrete shall be placed thereon until such water is removed. To avoid flow of water over/around freshly placed concrete, suitable drains and sumps shall be provided. During summer season, temperature of water should be maintained, as per the criteria and for the same, icing should be done for concreting work. Bonding Mortar Immediately before concrete placement begins, prepared surfaces except formwork, which will come in contact with the concrete to be placed, shall be covered with a bonding mortar as specified. The corrosive matters on the reinforcement should be removed by means of wire brush. Laitance should be removed by means of chiseling from top concrete layer which was earlier concreted

5.4.24 Transportation

All buckets, containers or conveyors used for transporting concrete shall be mortar-tight, leak proof irrespective of the method of transportation adopted, concrete shall be delivered with the required consistency and plasticity without segregation or loss of slump. However, chutes shall not be used for transport of concrete without the written permission of the Engineer-in-Charge and concrete shall not be re- handled before placing.

5.4.25 Re tempered or Contaminated Concrete

Concrete must be placed in its final position before it becomes too stiff to work. On no account, water shall be added after the initial mixing. Concrete, which has become stiff or has been contaminated with foreign materials shall be rejected and disposed off as directed by the Engineer-in- Charge.

5.4.26 Avoiding Segregation

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

5.4.27 Placing by Manual Labour

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

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

5.4.28 Types of Buckets

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

5.4.29 Operation of Bucket

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

5.4.30 Placement of Restricted Forms

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

5.4.31 Chuting

Where it is necessary to use transfer chutes, specific approval of Engineer-in-Charge must be obtained to type, length slopes, baffles, vertical terminals and timing of operations. These shall be so arranged that an almost continuous flow of concrete is obtained at the discharge and without segregation. Concrete should flow smoothly in the chute and there should not be any obstruction to the flow. To allow for the loss of mortar against the sides of the chutes, the first mixes shall have less coarse aggregate. During cleaning of chutes, the wastewater shall be kept clear of the forms. Concrete shall not be permitted to fall from the end of the chutes by more than 1.0 m. Chutes, when approved for use shall have slopes not flatter than 1 vertical,

3 horizontal and not steeper than 1 vertical, 2 horizontal. Chutes shall be of metal or metal lines end of rounded cross section. The slopes of all chute sections shall be approximately the same. The slopes of all chute sections shall be approximately the same. The discharge end of the chutes shall be maintained above the surface of the concrete in the forms.

5.4.32 Placing by Pumping/Pneumatic Placers

Concrete may be conveyed and placed by mechanically operated equipment e.g., pumps or pneumatic placers only with the written permission of the Engineer-in-Charge at no extra cost. The slump shall be held to the minimum necessary for conveying concrete by this method.

When pumping is adopted, before pumping of concrete is started, the pipeline shall be lubricated with one or two batches of mortar composed of one part cement and two parts sand. Care shall be taken to avoid stoppages in work once pumping has started. When a pneumatic placer is used, the manufacturer's advice on layout of the pipeline shall be followed to avoid blockages and excessive wear. Restraint shall be provided at the discharge box to cater for the reaction at this end. Manufacturer's recommendations shall be followed regarding concrete quality and all other related matters when pumping/ pneumatic placing equipment is used. It should be noted that no extra payment is made for these items, if required and directed by Engineer-in Charge.

5.4.33 Concrete in Layers

Concreting, once started, shall be continuous until the pour is completed. Concrete shall be placed in successive horizontal layers of uniform thickness ranging from 15 cm to

45 cm directed by Engineer-in-Charge. These shall be placed as rapidly practicable to prevent the formation of cold joints or planes of weakness between each succeeding layer within the pour. The thickness of each layer shall be such that it can be deposited before the previous layer has stiffened. The bucket loads or other units of deposit, shall be spotted progressively along the face of the layer with such overlap as will facilitate spreading the layer to uniform depth and texture with a minimum shoveling. Any tendency to segregation shall be corrected by shoveling stones into mortar rather than mortar on to stones. Such a condition shall be corrected by redesign of mix or other means, as directed by the Engineer-in-Charge. Cover Blocks

Cover blocks of required size depending on the cover of the reinforcement as mentioned in the drawings shall be prepared in 1:3 cement mortar with fine aggregates and minimum compressive strength of 300 kg/sq.cm.

5.4.34 Bedding of Layers

The top surface of each pour and bedding planes shall be approximately horizontal unless otherwise instructed. Top layer should be rough and with key for further extension of work.

5.4.35 Compaction

Concrete shall be compacted during placing with approved vibrating equipment until the concrete has been consolidated to the maximum practicable density, as specified in the IS, is free of pockets of coarse aggregate and fits tightly against all form surfaces, reinforcement and embedded fixtures. Particular care shall be taken to ensure that all concrete placed against the form faces and into corners of forms against hardened concrete

at joints is free from voids or cavities. The use of vibrators shall be consistent with the concrete mix and caution exercised not to over vibrate the concrete to the point that segregation results.

5.4.36 Type of Vibrators

Vibrators shall conform to BIS specifications. Type of vibrator to be used shall depend on the structures where concrete is to be placed. Shutter vibrators to be effective, shall be firmly secured to the formwork which must be sufficiently rigid to transmit the vibration and strong enough not to be damaged by it. Immersion vibrators in sufficient numbers and each of adequate size shall be used to properly consolidate all concrete. Tapping or external vibrating of forms by hand tools or immersion vibrators will not be permitted.

5.4.37 Use of Vibrators

The exact manner of application and the most suitable machines for the purpose must be carefully considered and operated by experienced men. Immersion vibrators shall be inserted vertically at points not more than 450 mm apart and withdrawn when air bubbles cease to come to the surface. Immersion vibrators shall be withdrawn very slowly. In no case shall immersion vibrators be used to transport concrete inside the forms. Particular attention be paid to vibration at the top of a lift e.g. in a column or wall.

5.4.38 Melding Successive Batches

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

5.4.39 Penetration of Vibrators

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

5.4.40 Vibrating against Reinforcement/Formwork

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

5.4.41 Use of Form Attached Vibrators

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

5.4.42 Use of Surface Vibrators

The use of surface vibrators will not be permitted under normal conditions. However, for thin slabs, surface vibrating by specially designed vibrators may be permitted, upon approval of Engineer in-Charge.

5.4.43 Stone Pockets And Mortar Pondages

The formation of stone pockets and mortar pond ages in corners and against faces of forms shall not be permitted. Should these occur, they shall be dug out, reformed and refilled to sufficient depth and shape for thorough bonding, as directed by the Engineer-in-Charge.

5.4.44 Placement Interval

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

5.4.45 Special Provision in Placing

When placing concrete in walls with openings, in floors of integral slabs and beam construction and other similar conditions, the placing shall stop when the concrete reaches

the top of the opening in walls or bottom horizontal surface of the slab, as the case may be.

Placing shall be resumed before the concrete in place takes initial set, but not until it has had time to settle as determined by the Engineer-in-Charge.

5.4.46 Placing Concrete Through Reinforcing Steel

When placing concrete through reinforcing steel, care shall be taken to prevent segregation of the coarse aggregate. Where the congestion of steel makes placing difficult, it may be necessary to obtain Engineer in-Charge's permission for temporarily moving the top steel aside for proper placement & for restoring reinforcement as per drawing.

5.4.47 Bleeding

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

5.4.48 Application of Araldite for Bonding of New and Old Concrete

General

Araldite epoxy resins will be used to bond fresh concrete to concrete that is fully cured, to give a monolithic bond capable of transmitting high stresses when traditional bonding agents such as cement slurry cannot always be relied upon to provide good adhesion which is particularly the case when large areas are involved.

The Araldite based formulation shall be applied to a suitably prepared concrete sub-strata and the fresh concrete poured as soon as possible, but always during the 'open time' of the adhesive.

Materials used shall be of best quality like CIBA, FOSROC or ROFF and approved by the Engineer-in-Charge.

Manufacturer's instructions shall be followed in all respects. No separate payment shall be paid for this item of work.

Formulation

ARALDITE	**GY250**	**100**	**Parts by weight**
Hardener	**HY825**	**20**	**Parts by weight**
Hardener	**HY830**	**20**	**Parts by weight**
Hardener	**HY850**	**20**	**Parts by weight**
Silica Flour		**20**	**Parts by weight**

Application

The application of the adhesives shall be as per manufacturer standards.

Preparation of the Substrata

To obtain good adhesion, it is necessary to have clean and sound substrata. Preparation can be carried out using a variety of techniques including chemical treatment and mechanical methods such as grinding, milling, and abrading, planning and sand blasting. Dust and loose particles resulting from the pretreatment should be removed by vacuum cleaning or oil-free or blast.

Mixing

The resin and hardener should be thoroughly mixed in the dry filler. The mixed, ready to use adhesive should not contain lumps of unwetted filler and should be of uniform color. For a total weight of 1 kg or less hand mixing should be sufficient. For quantities in excess of 1 kg, the use of a mechanical mixer is recommended.

Pot life and 'Open time'

The pot life is the period during which the ready to use ARALDITE based formulation must be applied. After this period, the mix can no longer be worked and will have begun to set in its container. The table below indicates the pot life at different temperatures:

Mix Temperature	Pot life in minutes	90 Minutes
25	30 Minutes	
35 C	45 Minutes	

(The figures in this table are for batches less than 1 kilogram).

The 'Open time' is the maximum period of time allowable between application of the ARALDITE adhesive and pouring the fresh concrete. Exceeding the 'Open time' would result in considerably reduced adhesion. The adhesive should be applied to the pre-treated substrata as soon as the components have been mixed and fresh concrete poured immediately afterwards.

Accurate knowledge of the 'Open time' is essential in case the work is interrupted.

Table gives the 'Open time' of ARALDITE based formulations as a function of substrata temperature. In all cases, the adhesives shall be applied immediately after mixing. Any delay between mixing and application will reduce the 'Open time'. Fresh concrete must be poured before the adhesive begins to gel. New to old concrete bonding is not recommended at temperatures below 5-Degree Centigrade, as curing cannot be assured under these circumstances.

Methods of Application

The shape and size of the concrete structure will determine the method of application used. The ARALDITE based adhesive may be applied by hand using brushed, brooms or any other suitable applicator.

Suitability of Fresh Concrete

Best results are obtained when the water/ cement ratio of the new concrete is low as is practicable.

Coverage

One kilogram of the mixed ARALDITE adhesive including hardeners and filler covers an area of 2 to 3 sqm. When applied with a stiff nylon bristle brush. However, the coverage is very much dependent on the finish in the concrete.

Handling Precautions

Epoxy resins can cause irritation of the skin in sensitive person if incorrectly handled. Certain safety precautions must therefore be observed and those handling the resins and hardeners should be given suitable instructions. Those working with epoxy resins should, above all, be instructed that personal cleanliness at the place of work is essential. The resin and hardener should not be allowed to come into direct contact with the skin. The most effective protection is achieved by wearing rubber or polythene gloves, the latter having the advantage that they can be replaced when dirty. They are more pleasant to wear if cotton gloves are worn underneath. Parts of the skins, which have come into contact with the resin or hardener, should be washed with lukewarm water and a mild soap. Special cleaning creams may be used as they have proved to be highly suitable.

Construction Joints

A construction joint is defined as a joint in the concrete introduced for convenience in construction at which special measures are taken to achieve subsequent continuity without provision for further relative movement. No concreting shall be started until the Engineer-in-Charge has approved the method of placing the positions and form of the construction joints and lifts. The construction joints shall be so located as not to impair the strength of the structure. Water stops shall be inserted as per clause 3.20

Concrete placed to form the face of a construction joint shall have all Laitance removed and the aggregate exposed prior to the placing of fresh concrete. The Laitance shall wherever practicable be removed by spraying the concrete where it is still green. The whole of the concrete surface forming part of the joint shall be hacked to expose the aggregate to the 1/3rd size of maximum size of aggregate. Where aggregate is damaged during hacking, it shall be removed from the concrete face by further hacking. All loose matter shall be removed and the exposed surface thoroughly cleaned by wire brushing, air blasting or washing, leaving the surface clean and damp. Immediately before fresh concrete is placed, a 12 mm thick layer of sand/cement mortar mixed in the same proportions as in the concrete shall be spread in the horizontal face of the construction joint. A drier mix shall be used for the top lift of horizontal face of the construction joint. A drier mix shall be used for the top lift of horizontal pours to avoid Laitance. The new concrete shall be well worked against the prepared face before the mortar sets. Special care shall be taken to obtain thorough compaction and to avoid segregation of the concrete along the joint plane.

Movement Joints

Movement joints are defined as all joints intended to accommodate relative movement between adjoining parts of a structure, special provision being made where necessary for maintaining the water tightness of the joint. The contractor shall comply with the instructions of manufacturers of proprietary jointing materials and shall, if required by the Engineer-in- Charge, demonstrate that the jointing materials can be applied satisfactorily.

The surface of set concrete in a movement joint shall, as shown on the drawings, be painted with two coats of bituminous paint and new concrete shall be placed against it only when the paint is dry. Expansion joints shall be formed by a separating strip of approved preformed joint filler.

Caulking grooves shall be provided. At all joints where a caulking groove is formed, immediately prior to caulking, the groove shall be wire brushed and loose material removed and blown out by compressed air. After the groove has dried, it shall be primed and caulked with approved sealing compound applied in accordance with the manufacturer's instructions. At all caulked joints, the face of the caulking strip and a width of concrete on either side shall be painted with two coats of paint having the same base as the sealing compound.

Water Stops and Joint Fillers

Water stops

At all construction, contraction and expansion joints in the water retaining structures and wherever specified or directed by the Engineer-in-charge, water stops shall be provided. The water stops shall be PVC type or of any other equivalent material as approved by the Engineer-in-charge. PVC water stops shall have a tensile strength of not less than 14 MN/m2 and elongation at break of not less than 300%. Water stops shall not be exposed to direct sunlight for long periods. Before being concreted in water stops shall be cleaned of all foreign materials. Wherever provided, water stops shall be placed in such a manner that they are embedded in the adjacent sections of the panels for equal width.

As far as possible, jointing on site shall be confined to the making of butt joints in straight runs of water stops and all the joints should be monolithic. Where it is agreed with the Engineer-in-Charge that it is necessary to make an intersection or change of direction of any joint, other than a butt joint in a straight run on site, a preliminary joint, intersection or change of direction piece shall be made and submitted to such tests as the Engineer- in-Charge may require.

Flexible water stops shall be fully supported in the form work, free of nails and clear of reinforcement and other fixtures. Damaged water stops shall be replaced and during concreting care shall be taken to place the concrete so that water stops do not bend or distort or displace.

The different types of water stops to be used in liquid retaining structures will be as follows:

Table 9 : Types of Water Stops

Sr.	Type of Joint	Type of water stops

1.	Partial/complete Contraction joint in walls and slabs	230 mm wide, ribbed with hollow centre bulb & 6 mm minimum thickness
2.	Expansion joints in walls and slabs	230 mm wide, ribbed with hollow centre bulb & 9 mm minimum thickness
3.	Construction joint in raft	230 mm wide, ribbed with hollow centre bulb & 9 mm minimum thickness
4.	Construction joint in wall	230 mm wide, ribbed with hollow centre bulb & 6 mm minimum thickness
5.	Expansion joint raft	230 mm wide, ribbed with hollow centre bulb
Sr.	Type of Joint	Type of water stops
		& 9 mm minimum thickness
6.	Partial/complete Contraction joint in raft	230 mm wide, ribbed with hollow centre bulb & 9 mm minimum thickness

Jointing fillers

Joint fillers shall be of durable, compressible and non-extruding material. Details of jointing material required here. Type of joint, size or width of joint and joint filler material to be used with preferred brands if any.

Sealing Compounds

Horizontal joints shall, where used in water-retaining structures be sealed with a cold pouring poly sulphide rubber sealing compound of quality equal to, or better than serviced “Para seal”. Horizontal joints in roofs, floors and other non-water retaining structures shall be sealed with an approved sealant with properties equal to or better than serviced “Para plastic 41”. Vertical joints and joints in the soffits of slabs in both water retaining as well as non-water retaining structures shall be sealed with a trowel or gun applied poly sulphide rubber sealing compound such as serviced “Vertiseal”or equivalent. Sealing compounds shall be fully cured before water is permitted to come in contact. At 40 C, the curing time would be approximately 7 weeks for poly sulphide compounds like CIBA, FOSROC or ROFF as approved by Engineer-in-charge.

Tolerances in Concrete Surfaces

Concrete surfaces for the various classes of unformed and formed finishes specified in various clauses shall comply with the tolerances shown in Table hereunder, except where different tolerances are expressly required by the specification.

In the table ‘line and level’ and ‘dimension’ shall mean the lines, levels and cross sectional dimensions as specified and required.

Surface irregularities shall be classified as ‘abrupt’ or ‘gradual’. Abrupt irregularities include by shall not be limited to offsets and fins caused by displaced or misplaced formwork, loose knots and other defects in formwork materials, and shall be tested by direct measurement. Gradual irregularities shall be tested by means of a straight template for plane surfaces and 1.5 m long formed surfaces.

Class of		Maximum tolerance (mm) in:	

finish	Line & level	Abrupt irregularity	Gradual irregularity	Dimension
U 1	12	6	6	-
U 2	6	3	3	-
U 3	6	3	3	-
F 1	12	6	6	+12-6
Class of finish		Maximum tolerance (mm) in:		
	Line & level	Abrupt irregularity	Gradual irregularity	Dimension
F 2	6	6	6	+12-6
F 3	3	3	3	+6-

Curing, Protecting, Repairing and Finishing Curing

All concrete shall be kept continuously in a damp or wet condition by ponding or by covering with a layer of sacking, canvas, hessian or similar materials and kept constantly wet for at least seven days from the date of placing concrete in case of OPC and 10 days in case of mineral admixture or blended cements are used. The period of curing shall be not less than 10 days for concrete exposed to dry and hot weather condition

Curing with Water

Fresh concrete shall be kept continuously wet for a minimum period of 10 days from the date of placing of concrete, following a lapse of 12 to 14 hours after laying of concrete. The curing of horizontal surfaces exposed to the drying winds shall however begin as soon as the concrete has hardened. Water shall be applied to formed surfaces immediately upon removal of forms. Quantity of water applied shall be controlled so as to prevent erosion of freshly placed concrete.

Continuous Spraying

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

Alternate Curing Methods

Whenever in the judgment of the Engineer-in-Charge, it is necessary to omit the continuous spray method, a covering of clean sand or other approved means such as wet gunny bags, which will prevent loss of moisture from the concrete, may be used. No type of covering will be approved which would stain or damage the concrete during or after the curing period. Covering shall be kept continuously wet during curing period. For curing of concrete in sidewalks, floors, flat roofs of other level surfaces, the ponding method of curing is preferred. The method of containing the ponded water shall be approved by the Engineer-in Charge. Special attention shall be

given to edges and corners of the slabs to ensure proper protection to these areas. The ponded areas shall be kept continuously filled with water during the curing period.

Curing Compound

Surface coating type-curing compounds shall be used only by special permission of Engineer-in-Charge. Curing compounds shall be liquid type white pigmented, conforming to US Bureau of Reclamation specification. No curing compound shall be used on surfaces where future blending with concrete, water of acid proof membrane or painting is specified. Curing compound shall be used only after getting sufficient/satisfactory test results at site.

Curing Equipment

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

Protecting Fresh Concrete

Fresh concrete shall be protected from defacements and damage due to construction operations by leaving forms in place for an ample period as specified in section D3 of this specification. Newly placed concrete shall be protected by approved means such as tarpaulins from rain, sun and winds. Steps as approved by the Engineer-in-Charge shall also be taken to protect immature concrete from damage by debris, excessive lading, vibration, abrasion or contact with other materials, etc. that may impair the strength and/or durability of the concrete. Workmen shall be warned against and prevented from disturbing green concrete during its setting period. If it is necessary that the workmen enter the area of freshly placed concrete, the Engineer-in-Charge may require that bridges be placed over the area.

Repair and Replacement of Unsatisfactory Concrete

General

Immediately after the shuttering is removed, the surface of concrete shall be very carefully gone over and all defective areas called to the attention of the Engineer in-Charge who may permit patching of the defective areas or also reject the concrete unit either partially or in its entirety. Rejected concrete shall be removed and replaced by the contractor. Holes shall be filled with mortar composed of one part of cement to one and half parts of sand passing 2.36 mm I.S sieve after removing any loose stones adhering to the concrete. Concrete surfaces shall be finished as described in specifications or as directed by the Engineer-in-Charge. Superficial honey combed surfaces and rough patches shall be similarly made good immediately after removal of shuttering, in the presence of the Engineer in- charge and superficial water and air holes shall be filled in. The mortar shall be well worked into the surface with a wooden float. Excess water shall be avoided. Unless instructed otherwise by the Engineer-in-Charge, the surface of the exposed concrete placed against shuttering shall be rubbed down immediately on removal of shuttering to remove fine or other irregularities, care being taken to avoid damaging the surface. Surface irregularities shall be removed by grinding. If reinforcement is exposed or the honeycombing occurs at vulnerable positions e.g. ends of beams or columns, it may be necessary to cut out the member completely or in part and reconstruct. The decision of the Engineer-in-Charge shall be final in this regard. If only patching is necessary, the

edges being cut perpendicular to the affected surface or with a small undercut if possible. Anchors, tees or dovetail slots shall be provided whenever necessary to attach the new concrete securely in place. An area extending several centimeters beyond the edges and the surfaces of the prepared voids shall be saturated with water for 24 hours immediately before the patching material is placed.

For small repairs concerned Engineering-Charge shall permit to repair the same and shall be repaired at his directions. For major repairs contractor shall submit the method of statement and on approval of same shall carry such repairs with strict compliance to the method of statement.

Use of Epoxy

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

Method of Repair

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

The hole to be patched shall be roughened and thoroughly soaked with clean water until absorption stops. A 5 mm thick layer of grout of equal parts of cement and sand shall be well brushed into the surface to be patched, followed immediately by the patching concrete which shall be well consolidated with a wooden float and left slightly protrude of the surrounding surface. The concrete patch shall be built up in 10 mm thick layers, after an hour or more, depending upon weather conditions, it shall be worked off flush with a wooden float and a smooth finish obtained by wiping with hessian. A steel trowel shall be used for this purpose. The mix for patching shall be of the same materials and in the same proportion as that used in the concrete being repaired, although some reduction in the maximum size of the coarse aggregates may be necessary and the mix shall be kept as dry as possible. Mortar filling by air pressure (gunniting) shall be used for repair of areas too large and/or too shallow for patching with mortar. Patched surfaces shall be given a final treatment to match the colour and texture of the surrounding concrete. White cement shall be substituted for ordinary cement, if so directed by the Engineer-in-Charge, to match the shade of the patch with the original concrete.

Curing of Patched Work

The patched area shall be covered immediately with an approved non- staining, water-saturated material such as gunny bags which shall be kept continuously wet and protected against sun and wind for a period of 24 hours. Thereafter, the patched area shall be kept wet continuously by a fine spray, or sprinkling for not less than 10 days. All fillings shall be tightly bounded to the concrete and shall be sound, free from shrinkage cracks after the fillings have been cured and dried. **Approval by the Engineer- in-Charge**

All materials, procedures and operations used in the repair work shall be subject to the approval of the Engineer-in-Charge.

Finishing General

The type of finish for formed concrete surfaces shall be as follows, unless varied by the design/architectural drawings and specifications.

When the structure is in service all the surfaces shall receive no special finish, except repair of damaged or defective concrete, removal of fine and abrupt irregularities, filling defective concrete, filling of holes left by form ties and rods and clean up of loose or adhering debris. Surfaces which will be exposed to the weather and which would normally be level, shall be sloped for drainage. Unless a horizontal surface or the slope required is specified, the tops of narrow surfaces such as stair treads, walls, curbs and parapets shall be sloped across the width approximately 1 in 30. Broader surfaces such as walkways, and platforms shall be sloped about 1 in 50. Surfaces that will be covered by backfill or concrete, subfloors to be covered with concrete topping, terrazzo or quarry tiles and similar surfaces shall be smooth ascended and leveled to produce even surfaces. Surface irregularities shall not exceed 6 mm. Surfaces which will not be covered by backfill, concrete or tile toppings such as outside decks, floors of galleries and sumps, parapets, gutters, side-walks, floors and slabs, shall be consolidated, screened and floated. Excess water and laitance shall be removed before final finishing. Floating may be done with hand or power tools and started as soon as the screened surface has attained a stiffness to permit finishing operations and these shall be the minimum required to produce a surface uniform in texture and free from screened marks or other imperfections. Joints and edges shall be tooled as specified or as directed by the Engineer-in-Charge.

Standard Finish for Exposed Concrete

Exposed concrete shall mean any concrete, other than floors or slabs, exposed to view upon completion of the works. Unless otherwise specified, the standard finish for exposed concrete shall be a smooth finish. A smooth finish shall be obtained with the use of lined or plywood forms having smooth and even surfaces and edges. Panels of forms shall be of uniform size and be as large as practicable and installed with closed joints. Upon removal of forms the joint marks shall be smoothed off and all blemishes, protections etc., removed leaving the surfaces smooth.

Integral Cement Concrete Finish

When specified, an integral cement concrete finish of specified thickness for floors and slabs shall be applied either monolithic or bonded, as specified or directed by the Engineer-in-charge. The surface shall be tested with a straight edge and any high and low spots eliminated. Floating or trowelling of the finish shall be permitted only after all surface water has evaporated. Dry cement or a mixture of dry cement and sand shall not be sprinkled directly on the surface of the cement finish to absorb moisture or to stiffen the mix.

Rubbed Finish

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

Protection

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

Hot Weather Requirement

All Concrete work performed in hot weather shall be in accordance with IS:456, except as herein modified.
Admixtures may be used only when approved by the Engineer-in-Charge. Adequate provisions shall be made to lower give limit concrete temperatures by cool ingredients, eliminating excessive mixing, preventing exposure of mixers and conveyors to direct sunlight and the use of reflective paint on mixers, etc. The temperature of the freshly placed concrete shall not be permitted to exceed 38 degrees centigrade.

Consideration shall be given to shading aggregate stockpiles from direct rays of the sun and spraying stockpiles with water, use of cold water when available, and burying, insulating, shading and/or painting white the pipelines and water storage tanks and conveyance.
In order to reduce loss of mixing water, the aggregate, wooden forms, sub grade, adjacent concrete and other moisture absorbing surfaces shall be well wetted prior to concreting, placement and finishing shall be done as quickly as possible. Extra precautions shall be taken for the protection and curing of concrete. Consideration shall be given to continuous water curing and protection against high temperatures and drying hot winds for a period of at least 7 days immediately after concrete has set and after which normal curing procedures may be resumed.

Placing Concrete Underwater

Under all ordinary conditions, all foundations shall be completely dewatered and concrete placed in the dry. However, when concrete placement under water is necessary, all work shall conform to IS:456 and the procedure shall be as follows: Method of Placement Concrete shall be deposited underwater by means of tremises, or drop bottom buckets of approved type.

Direction, Inspection and Approval
All work requiring placement of concrete underwater shall be designed, directed and inspected with due regard to local circumstances and purposes. All underwater concrete shall be placed according to specifications approved by the Engineer-in- Charge.

a) Special precautions shall be taken for prevention of lifting of concrete due to uplift pressure of sub soil water.

Precast Concrete General

Precast concrete units, whether manufactured on or off site, shall comply in every way with the provisions of the contract for in situ concrete. Wherever possible, precast units shall be hydraulically pressed. When ready for incorporation in the works, precast units shall be responsible for the accuracy of the level, shape of the bed or platform. A suitable serial number and the date of casting shall be impressed or painted on each unit.

Striking Forms

Side shutters shall not be struck in less than 24 hours after depositing concrete and no precast unit shall be lifted until the concrete reaches strength of at least twice the stress to which the concrete may be subjected to at the time of lifting.

Precast Units

The lifting and removal of precast units shall be undertaken without causing shock, vibration or undue bending stresses to or in the units. Before lifting and removal takes place, contractor shall satisfy the Engineer-in-Charge or his representative that the methods he proposes to adopt for these operations will not over-stress or otherwise effect seriously the strength of the precast units.
The reinforced side of the units shall be distinctly marked.

Curing

All precast work shall be protected from the direct rays of the sun for at least 7 days after casting and during that period each unit shall be kept constantly watered or preferably be completely immersed in water if the size of the unit so permits.

35.1.a.2.a.1 Slots, Openings, Etc.

General

Slots, openings or holes, pockets, etc., shall be provided in the concrete work in the approved positions as per design drawings and as directed by Engineer-in Charge and extra reinforcement should be provided as per design requirement.
Short pipes with puddle collar shall be fixed in the side wall of suction pipes. They shall be supplied at the appropriate time during construction. Any deviation from the approved drawings shall be made good by contractor at his own expense, without damaging any other work. Sleeves, bolts, inserts etc., shall also be provided in concrete work where so required.

Grouting Standard Grout

The proportions of grout shall be such as to produce a flow able mixture
Consistent with minimum water content and s h r i n k a g e . The grout proportions shall be limited as follows:

Table 10 : Proportions for Standard Grout

Sr.	Use	Grout thickness	Mix proportions	W/c ratio (max.)
1.	Fluid	Under 25 mm	One part Portland cement to one part sand	0.44
2.	General	25mm & over but less than 50mm	One part Portland cement To 2 parts of sand	0.53
3.	Stiff Mix	50mm & over	One part Portland cement to 3 parts of sand	0.53

Sand shall be such as to produce a flow able grout without any tendency to segregate. Sand for general grouting purposes shall be graded within the following limits:

Passing BIS	2.36mmsieve	95 to100%
Passing BIS	1.18mmsieve	65 to 95%
Passing BIS	300 micron sieve	10 to30%
Passing BIS	150micronsieve	3 to10%

Sand for fluid grouts shall have the fine material passing the 300 and 150 micron sieves at the upper limits specified above. Sand, for still grouts, shall meet the usual grading specifications for concrete laitance. Anchor bolts, anchor bolt holes and the bottoms of equipment and column base plates shall be cleaned of all oil, grease, dirt and loose material. The use of hot, strong caustic solution for this purpose will be permitted. Prior to grouting, the hardened concrete surfaces to be grouted shall be saturated with water. Water in anchor bolt holes shall be removed before grouting is started. Forms around base plates shall be reasonably tight to prevent leakage of the grout. Adequate clearance shall be provided between forms and base plate to permit grout to be worked properly into place. Grouting, once started, shall be done quickly and continuously to prevent segregation, bleeding and breakdown of initial set. Grout shall be worked from one side of one end to the other to prevent entrapment of air. To distribute the grout and to ensure more complete contact between base plate and foundation and to help release trapped air, link chains can be used to work the grout into place. Grout throughout holes in base plates shall be by pressure grouting. Variations in grout mixes and procedures shall be permitted if approved by the Engineer-in-Charge.

Non-Shrinking Grout for Equipment Foundation

Non-shrinking grout shall be used for grouting of machine base plates, anchor bolts, other anchoring devices and at locations where ordinary grouts are ineffective due to shrinkage. It shall be composed of a type of expansive hydraulic sheeting binder and select-graded aggregates. It shall have properties as mentioned below:

Table 11 : Proportions for Non-Shrinking Grout

Sr.	**Properties**	**Values**
1	Maximum grain size	6 mm
2	Water % (for 80% flow)	15.17
3	Density of hardened grout	2.27 - 2.30 gm/m1
4	Compressive strength N/mm^2	
	Minimum 3 days	23
	7 days	34
	28 days	45
5	Expansion %	
	Free	0.10 - 0.20
	Restrained	0.08 - 0.12
	Restrained	0.08 - 0.12

Mixing, batching, cleaning, preparation of surface and curing of non-shrinking grout shall be done as per manufacturer's instructions. Brands like FOSROC or BUILDMASTER etc. shall be used as per manufacturer specifications.

Inspection

All materials, workmanship and finished construction shall be subject to continuous inspection and approval of the Engineer-in-Charge.
All materials supplied by the Contractor and all work or construction performed by the Contractor which is rejected as not being in conformity with the specifications and requirements, shall be immediately replaced.
All concrete shall be protected against damage until final acceptance by the Engineer-in-Charge.

Clean-Up

Upon completion of the concrete work, all forms, equipment, construction tools, protective coverings and any debris resulting from the work shall be removed from the premises.
All debris i.e. empty containers, scrap wood, etc., shall be removed to "dump" daily, or as directed by the Engineer-in-Charge.
The finished concrete surfaces shall be left in a clean condition satisfactory to the Engineer-in-Charge. Records of Concreting
An accurate and up to date record showing times, dates, weather and temperature conditions when various positions of all the concrete structures forming the works were concreted will be kept by the contractor and shall be countersigned by the Engineer-in-Charge. If the Contractor fails to sign the Engineer-in-Charge's record, it shall nevertheless be regarded as correct and binding on the Contractor. The Contractor has to submit concrete pour card in duplicate duly to be signed to the Engineer-in-Charge for each type of concreting work. Contractor shall keep copy of it, after Engineer-in-Charge has checked and signed the pour card.

Foundation Bedding, Bonding and Jointing

In no case foundation shall rest on any loose strata or loose pockets etc. even though it has reached level shown on design drawings and referred back to design engineer / Engineer-in-Charge
All surfaces upon or against which concrete will be placed shall be suitably prepared by thoroughly cleaning, washing and dewatering, as specified or as the Engineer-in-Charge may direct, to meet the various situations encountered in the work.
Soft or spongy areas shall be cleaned out and backfilled with lean concrete or clean sand fill compacted.
Prior to construction of formwork for any item where soil will act as bottom form, approval shall be obtained from the Engineer-in-Charge for the suitability of the soil.

Preparation of Rock Strata of Foundations

To provide tight bond with rock foundations, the rock surface shall be prepared and the following general requirements shall be observed.
Concrete shall not be deposited on large sloping rock surfaces. Where required by the Engineer-in-Charge, the rock shall be cut to form rough steps or benches to provide roughness or a more suitable bearing surface. Rock foundation stratum shall be prepared by picking, barring, wedging and similar methods which will leave the rock in an entirely sound and unsheltered condition.
Shortly before concrete is placed, the rock surface shall be cleaned with high pressure water and air jet even though it may have been previously cleaned in that manner.

Prior to placing concrete, the rock surface shall be kept wet for a period of 2 to 4 hours unless otherwise directed by the Engineer-in-Charge.
Before placing concrete on rock surfaces all water shall be removed from depressions to permit thorough inspection and proper bonding of the concrete to the rock. Formwork

Formwork, Fixing and General

All formwork shall be constructed of waterproof plywood or preferably sheet metal. Plywood used for form work shall be conforming to BIS: 4990
i.e. Specification for plywood for concrete shuttering works. The materials for formwork shall got approved by the Engineer-in-Charge before starting the work. Formwork shall be firmly supported, adequately strutted, braced and tied to withstand the placing and vibrating of concrete and the effects of weather. The tolerance on line and level shall not exceed 3 mm and the soffits of beams other than pre-stressed beams shall in the absence of any specified camber, be erected with an upward camber of 6 mm for each 3 meters of span.
The Contractor shall be responsible for the calculations and designs for the formwork, and if required, shall submit them to the Engineer-in-Charge for approval before construction. On form work to external faces, which will be permanently, exposed, all horizontal and vertical formwork joints shall be so arranged that joint lines will form a uniform pattern on the face of the concrete. Where the Contractor proposes to make up the form work for standard sized manufactured form work panels, the size of such panels shall be approved by the Engineer-in-Charge before they are used in the construction of the Works. The finished appearance of the entire elevation of the structure and adjoining structures shall be considered when planning the pattern of joint lines caused by form work and by construction joint to ensure continuity of horizontal and vertical lines.
Faces of form work in contact with concrete shall be free from adhering foreign matter, projecting nails and the like, splits or other defects, and all form work shall be clean and free from standing water, dirt, shavings, chippings or other foreign matter. Joints shall be sufficiently watertight to prevent the escape of mortar or the formation of fins or other blemishes on the face of the concrete and no bleeding should be allowed through the joints.

Form work shall be provided for the top surfaces of sloping work where the slope exceeds fifteen degrees from the horizontal (except where such top surface is specified as spaded finish) and shall be anchored to enable the concrete to be properly compacted and to prevent flotation, care being taken to prevent air being trapped.

Openings for inspection of the inside of the form work and for the removal of water used for washing down shall be provided and so formed as to be easily closed before placing concrete. Before placing concrete, all bolts, pipes or conduits or other fixtures which are to be built in shall be fixed in their correct positions, and cores and other devices for forming holes shall be held fast by fixing to the formwork or otherwise. Holes shall not be cut in any concrete without approval of the Engineer-in-Charge.

All exterior angles on the finished concrete of 90 degree or less shall be given 20 mm x 20 mm chamfers unless otherwise ordered by the Engineer-in-Charge.

No ties or bolts or other device shall be built into the concrete for the purpose of supporting formwork without the prior approval of the Engineer- in-charge. The whole or part of any such supports shall be capable of removal so that no part remaining embedded in the concrete shall be nearer than 50 mm from the surface in the case of reinforced concrete and 150 mm in

the case of unreinforced concrete. Holes left after removal of such supports shall be neatly filled with well rammed dry-pack mortar.

Formwork in contact with the concrete shall be treated with suitable non- staining mould oil to prevent adherence of the concrete except where the surface is subsequently to be rendered. Care shall be taken to prevent the oil from coming in contact with reinforcement or with concrete at construction joints. Surface retarding agents shall be used only where ordered by the Engineer-in-Charge.

No formwork shall be started or placed unless the requirement work is fully completed and checked by Engineer-in-Charge.

Necessary cover blocks shall be provided before starting connection.

Removal of Formwork

Formwork shall be so designed as to permit any removal without resorting to hammering or levering against the surface of the concrete.
The periods of time elapsing between the placing of the concrete and the striking of the loads likely to be imposed on the concrete and shall in any case be not less than the periods shown in Table below. Where soffit formwork is constructed in a manner during and after such removal of a sufficient number of adequate supporting props in an undisturbed condition, the Contractor may, with the agreement of the Engineer-in- Charge, remove the formwork at the earlier times listed below provided that the props are left in position.

Table 12 : Period for Formwork

Position of formwork	Days for striking
Walls	1
Sides of beams and columns	2
Slabs (Drops left under)	3
Props to slabs (span not exceeding 4.5m)	7
Props to slabs (span exceeding 4.5 m)	14
Beams soffits (props left under)	7
Props to beams (span not exceeding 6 m)	14
Props to beams (span exceeding 6 m)	21
Circular structures, domes ,cantilever portions etc.	21

Notwithstanding the foregoing, the Contractor shall be held responsible for any damage arising from removal of formwork before the structure is capable of carrying its own weight and any incidental loading.
Striking shall be done slowly with utmost care to avoid damage to projections and without shock or vibration, by gently easing the wedges. If after removing the formwork it is found that timber has been embedded in the concrete. It shall be removed and made good as specified earlier.
Reinforced temporary openings shall be provided, as directed by the Engineer in-Charge, to facilitate removal of formwork which otherwise may be inaccessible.

The rods, clamps, form bolts, etc. which must be entirely removed from walls or similar structures shall be loosened not sooner than 24 hours not later than 40 hours after the concrete has been deposited. Ties, except those required to hold forms in place, may be removed at the same time. Ties, withdrawn from walls and grade beams shall be pulled toward the inside face. Cutting ties back from the faces of the walls and grade beams will not be permitted.

For liquid retaining structures, no sleeves for through bolts shall be used nor shall through bolts be removed as indicated above. The bolts, in this case, shall be cut at 25 mm depth or more from the surface and then the hole shall be made good by cement sand mortar of the same proportions as the concrete just after striking the form work.

Formed Surfaces - Classes of Finish

Finishes to formed surfaces of concrete shall be classified as F1, F2, or F3, or such other special finish as may be particularly specified. Where the class of finish is not specified the concrete shall be finished to Class F1.

Form work for Class F3 finish shall be lined with as large panels as possible of non-staining material with a smooth unblemished surface such as sanded plywood or hard compressed fiber board, arranged in a uniform approved pattern and fixed to back form work by oval nails. Unfaced wrought boarding or standard steel panels shall not be permitted.

Form work for Class F2 finish shall be faced with wrought tongued and grooved boards or plywood or metal panels arranged in a uniform approved pattern free from defects likely to detract from the appearance of the surface.

Form work for Class F1 finish shall be constructed in sheet metal. Surfaces subsequently to be rendered, plastered or tiled shall be adequately scrabbled or hacked as soon as the form work is removed to reduce the irregularities to not more than half the thickness of such rendering, plastering or bedding for tiles and to provide a satisfactory key.

Defects in Formed Surfaces

Workmanship in formwork and concreting shall be such that concrete shall normally require no making good, surfaces being perfectly compacted and smooth.

If any blemishes are revealed after removal of formwork, the Engineer- in Charge's decisions concerning remedial measures shall be obtained immediately. These measures may include, but shall not be limited to the following:

Fins, pinhole bubbles, surface discoloration and minor defects may be rubbed down with sacking immediately after the formwork is removed.

Abrupt and gradual irregularities may be rubbed down with carborundun and water after the concrete has been fully cured. These and any other defects shall be remedied by methods approved by the Engineer-in- Charge which may include using a suitable epoxy resin or, where necessary, cutting out to a regular dovetails shape at least 75 mm deep and refilling with concrete over steel mesh reinforcement sprung into the dovetail.

The form work shall be checked by the Engineer-in-Charge before the form work starts and form found defective shall be rejected and the same can be used after rectifying the defects and with due approval of the Engineer-in-Charge

35.1.a.2.a.2 Holes to be Filled

Holes formed in concrete surfaces by form work supports or the like shall be filled with dry-pack mortar made from one part by weight of ordinary Portland cement and one part fine aggregate passing BIS sieve 1.18 mm. The mortar shall be mixed with only sufficient water to make the materials stick together when being molded in the hands.

The contractor shall thoroughly clean any hole that is to be filled with dry- pack mortar and where the surface has been damaged, the contractor shall break out any loose, broken or

cracked concrete or aggregate. The concrete surrounding the hole shall then be thoroughly soaked after which the surface shall be dried so as to leave a small amount of free water on the surface. The surface shall then be dusted lightly with ordinary Portland cement by means of a small dry brush until the whole surface that will come into contact with the dry-pack mortar has been covered and darkened by absorption of the free water on the surface. The surface shall then be dusted lightly with ordinary Portland cement by means of a small dry brush until the whole surface that will come into contact with the dry- pack mortar has been covered and darkened by absorption of the free water by the cement. Any dry cement in the hole shall be removed.

The dry-pack material shall then be placed and packed in layers having a compacted thickness not greater then 15 mm. The compaction shall be carried out by use of a hardwood stick and a hammer and shall extend over the full area of the layer, particular care being taken to compact the dry-pack against the sides of the hole. After compaction, the surface of each layer shall be scratched the dry-pack fill and striking the block several times. Steel finishing tools shall not be used and water shall not be added to facilitate finishing.

Tolerances

Tolerance is a specified permissible variation from lines, grade or dimensions given in approved drawings. No tolerance specified for horizontal or vertical building lines or footings shall be construed to permit encroachment beyond the legal boundaries. Unless otherwise specified, the following tolerances will be permitted:

Tolerances for RCC Structures

(i)	Variation from the plumb In the lines and surfaces of columns, piers, walls 5 mm per 2.5 m or 25 mm,whichever is less For exposed corner columns and other conspicuous lines	5 mm 10 mm
	In any bay or 5 m maximum In 10 m or more	
(ii)	Variation from the level or from the grades indicated on the approved drawings In slab soffits, ceilings, beam soffit, and in arises In 2.5 m In any bay or 5 m maximum In 10 m or more For exposed lintels, sills, parapets, horizontal grooves and other conspicuous lines In any bay or 5 m maximum In 10 m or more	 5 mm 10mm 15mm 5 mm
(iii)	Variation of the linear building lines from established position in plan and related position of columns, wall and partitions In any bay or 5 m maximum In 10 m or more	 10mm 20mm
(iv)	Variation in the sizes and locations of sleeves, openings in wall sand floors except in the case of and for 5mm anchor bolts	
(v)	Variation in cross sectional dimensions of columns and beams and in the thickness of slabs and walls Minus Plus	5 mm 10 mm

(vi)	Footings Variation in dimension in plan Minus Plus	 10 mm
(vii)	Misplacement or eccentricity 2% of footing width in the direction of misplacement but not more than 50 mm Reduction in thickness: Minus 5% of specified thickness subject to a maximum of 50 mm	
(viii)	Variation in steps In a flight of stairs Rise Tread In consecutive steps Rise Tread Tolerances in other Concrete Structures	 3mm 5mm 1.5 mm 3mm
(ix)	All structures Variation of the constructed linear outlines from established position in plan In 5 m In 10 m or more	 10mm 15mm
	Variations of dimensions to individual structural features from established positions In 20 m or more In buried construction Variation from plumb, from specified batter orfrom curved surfaces of all structures In 2.5 m In 5 m In 10 m or more In buried construction twice the above amounts Variation from level or grade indicated on approved drawings in slab, beams soffits, horizontal grooves and visible arises In 2.5 m In 7.5 m or more In buried construction Variation in cross-sectional dimensions of columns, beams, buttresses, piers and similar members Minus Plus	 25 mm 50 mm 10 mm 15 mm 25 mm 5 mm 10 mm Twice the above amounts 5 mm 10 mm

(x)	Footings for columns, piers, walls, buttresses and similar members Variation of dimensions in plan Minus Plus Misplacement or eccentricity Reduction in thickness 5% of specified thickness subject to a maximum of 50 mm	 10mm 50mm 2% of footing width in the direction of misplacement but not more than 50 mm.
(xi)	Tolerance in other types of structures shall generally conform to those given in Clause 2.4 of Recommended Practice for Concrete Formwork (American Concrete Institute Act 347).	
(xii)	Tolerance in fixing anchor bolts shall be as follows: Anchor bolts without sleeves Anchor bolts with sleeves 3 mm for bolts Embedded parts	 + 5 mm + 5 mm for bolts up to 20 mm dia above 32 mm dia + 5 mm in all directions

Bracing, Struts and Props

Form work shall be braced, strutted, propped and so supported that it shall not deform underweight and pressure of the concrete and also due to the movement of men and other materials. Bamboo shall not be used as props or cross bearers.

The formwork for beams and slabs shall be so erected that the formwork on the sides of the beams and under the soffit of slabs can be removed without disturbing the beam bottoms. Repropping of beams shall not be done except when props have to be reinstated to take care of construction loads anticipated to be in excess of the design load. Vertical props shall be supported on wedges or other measures shall be taken whereby the props can be gently lowered vertically while striking the formwork.

If the formwork for a column is erected for the full height of the column, one side shall be left open and built up in sections as placing of the concrete proceeds, or windows may be left for pouring concrete from the sides to limit the drop of concrete to 1.0 m as directed by the Engineer-in- Charge.

Contractor shall submit the detailed design and methodology with applicable drawings if any of Formwork system for different members for approval of Engineer-in-Charge.

5.3 Reinforcement

5.6.1 Relevant IS Codes

IS:432	:	Mild steel and medium tensile steel bars &hard drawn steel wire for concrete reinforcement
IS:1786	:	Cold twisted steel bars for concrete reinforcement
IS:2502 (1963)	:	Code of practice for bending and fixing of bars for concrete reinforcement
IS:55225(1969)	:	Recommendations for detailing of reinforcement in RCC works
IS:2751	:	C.P. for welding of MS bars used for RCC
IS:9417	:	Recommendations for welding cold worked steel bars for RCC
IS:10790	:	Methods of sampling of reinforced steel

5.6.2 General

Reinforcement shall be high strength deformed corrosion resistant (CRS) bars as per IS:1786 – Fe415. Wire mesh or fabric shall be in accordance with IS:456. Substitution of reinforcement will not be permitted except upon written approval from the Engineer-in-Charge.

5.6.3 Storage

The reinforcement shall not be kept in direct contact with the ground but stacked on top of an arrangement of timber sleepers or the like.

If the reinforcing rods have to be stored for a long duration, they shall be coated with cement wash before stacking and/or be kept under cover or stored as directed by the Engineer-in-Charge.

Fabricated reinforcement shall be carefully stored to prevent damage, distortion, corrosion and deterioration.

It should be seen that the reinforcement will not be exposed to direct sunlight and preventive measures should be taken for the same.

5.6.4 Quality

All reinforcements shall be clean, free from grease, oil paint, dirt, loose mill scale, loose rust, dust bituminous material or any other substances that will destroy or reduce the bond. All rods shall be thoroughly cleaned before being fabricated.

Pitted and defective rods shall not be used. No welding of rods to obtain continuity shall be allowed unless approved by the Engineer-in-Charge. If welding is approved, the work shall be carried out as per IS:1786 - Fe415 according to the best modern practices and as directed by the Engineer- in Charge. In all cases of important connections, tests shall be made to prove that the joints are of full strength of bars welded. Special precautions, as specified by the Engineer-in-Charge, shall be taken in the welding of cold worked reinforcing bars and bars other than mild steel.

5.6.5 Laps

Laps and splices for reinforcement shall be as per IS: 456-2000. Splices in adjacent bars shall be staggered as mentioned in structural drawings and locations of all splices shall be approved by the Engineer-in-Charge.

Also contractor shall submit the Bar bending schedule for approval of Engineer in-Charge and shall follow same unless and until changed by any design changes.

5.6.6 Bending

Reinforcement bars supplied bent or in coils, shall be straightened before they are cut to size. Straightening of bars shall be done cold and without damaging the bars.

All bars shall be accurately bent according to the sizes and shapes shown on the approved detailed working drawings/bar bending schedules. They shall be bent gradually by machine or other approved means. Reinforcing bars shall not be straightened and re-bent in a manner that will injure the material; bars containing cracks/splits shall be rejected. They shall be bent cold, except bars of over 25 mm in diameter, which may be bent hot if specifically, approved by the Engineer in-Charge. Bars, which depend for their strength of cold working, shall not be bent hot. Bars bent hot shall not be treated beyond cherry red colour (nor exceeding 845 C) and after bending shall be allowed to cool slowly without quenching. Bars incorrectly bent shall be used only if the means used for straightening and re-bending be such as shall not, in the opinion of the Engineer in-Charge, injure the material. No reinforcement shall be bent when in position in the work without approval, whether or not it is partially embedded in hardened concrete. Bars having kinks or bends other than those required by design shall not be used.

5.6.7 Fixing

Reinforcement shall be accurately fixed by any approved means and maintained in the correct position shown in the approved Drawings by the use of blocks, spacers and chairs, as per IS:2502 to prevent displacement during placing and compaction of concrete. Bars intended to be in contact at crossing points shall be securely bound together at all such points with number 16 gauge GI wire. The vertical distances required between successive layers of bars in beams or similar members shall be maintained by the provision of mild steel spacer bars at such intervals that the main bars do not perceptibly sag between adjacent spacer bars. No binding wire shall protrude in cover area and shall bent inside.

5.6.8 Cover

Unless indicated otherwise, clear concrete cover for reinforcement (exclusive of plaster or other decorative finish) shall be as follows:

At each end of a reinforcement bar, not less than 25 mm nor less than twice the diameter of the bar whichever is greater for a longitudinal reinforcing bar in a column, not less than 40 mm, nor less than the diameter of the bar. In case of columns of minimum dimension of 20 cm or under with reinforcing bars of 12 mm and less in diameter, a cover of 25 mm may be used.

For longitudinal reinforcing bars in a beam, not less than 40 mm nor less than the diameter of the bar, whichever is greater for tensile, compressive, shear or other reinforcement in a slab, or wall, not less than, 20 mm, nor less than the diameter of such reinforcement. For any other reinforcement, not less than 20 mm, nor less than the diameter of such reinforcement.

For footing and other principal structural members in which the concrete is poured on a layer of lean concrete, the bottom cover shall be reduced to 60 mm. For concrete surfaces exposed to the weather or the ground after removal of forms, such as retaining walls, grade beams, footing sides and tops, etc. not less than 40 mm for bars larger than 16 mm diameter and not less than 30 mm for bars 16 mm diameter or smaller.

For liquid retaining structures, the minimum cover to all steel shall be 40 mm or the diameter of the main bar, whichever is greater.

The correct cover shall be maintained by cement mortar cubes or other approved means. Reinforcement for footings, grade beams and slabs on sub grade shall be supported on precast concrete blocks as approved by the Engineer-in Charge. The use of pebbles or stones shall not be permitted.

The 28 day crushing strength of cement mortar cubes/precast concrete cover blocks shall be at least equal to the specified strength of concrete in which these cubes/blocks are embedded.

The minimum clear distance between reinforcing bars shall be in accordance with IS:456

5.6.9 Inspection

After final erection of reinforcement, it shall be intimated to Engineer-in- Charge in writing or through pour cards. Erected and secured reinforcement shall be inspected and approved by the Engineer-in-Charge prior to placement of concrete.

5.6.10 Welding OF Reinforcement

Reinforcement which is specified to be welded shall be welded by any process which conforms with the requirements of IS:2751 and which the Contractor can demonstrate by bend and tensile tests will ensure that the strength of the parent metal is not reduced and that the weld possesses a strength not less than that of the parent metal. The welding procedure established by successful test welds shall be maintained and no deviation from this procedure shall be permitted. Welds in positions other than those shown on the approved Drawings shall not be permitted. Tack welding to lightly secure reinforcement in place will be permitted subject to approval of the Engineer-in-Charge.

5.6.11 Supply of Reinforcing Bars

Steel reinforcement, such as MS bars HYSD bars etc. required for the works shall be procured by contractor. Bidder shall consider use of any of the following brands of Steel bar reinforcements required for civil works for the proposed 14 MLD capacity Water Treatment Plant and associated works:
Steel bar reinforcement (Grade Fe 415): TISCON- CRS of TATA or High strength Rebar (Thermo-mechanically treated bar) of SAIL make.

The contractor shall arrange for transport, loading, unloading and storage at the work sites. The contractor should plan the procurement of steel in such a way that at least required quantity of steel of specified sizes is available at site for 3 months period.

Steel brought on site shall be stored in proper manner as approved by Engineer In Charge so as to avoid distortion, deterioration and corrosion. The contractor shall maintain proper register for the steel account, showing the steel received at site, steel used, and the balance stock on site, to the entire satisfaction of the Engineer-in-Charge

5.4 Structural Steel Work

5.7.1 Relevant IS Codes

IS:2062	:	Specification for Structural Steel (Fusion Welding Quality)
IS:800	:	C.P. for general construction in steel
IS:808	:	R.S. beam, channel and angel sections
IS:814	:	Covered electrodes for metal arc welding of structural steel
IS:1148	:	Hot rolled steel rivet bars for structural purpose
IS:1363	:	Black hexagon bolts, nuts, and lock nuts (dia 6 to 39mm) & black
		hexagon screws (dia 6 to 24mm)
IS:2062	:	Structural steel (fusion welding quality)
IS:3954	:	Hot rolled steel channel sections for general engineering purposes

SP-6 (I – VII)	:	ISI Handbook for Structural Engineers
SP-40	:	Handbook on structures with steel portal frames (without cranes)

5.7.2 General

Structural steel fabrication work shall include all types of steel structural work required for installation of platform for operation and installation of equipment where rolled steel sections are joined together either by bolting or riveting or welding as specified in the drawings/bill of quantities/directed by the Engineer. It shall also include fabrication and installation of air vessels/pressure vessels etc. Covers for ducts for electrical panels along with their seating arrangements are also classified under this heading unless they are provided separately under a different heading. Reaction tanks or storage vessels are also classified under this heading.

5.7.3 Materials

The MS structural members such as MS angles, channels, flats, I sections etc. shall conform IS 2062. Structural steel that is used for fabrication shall be conforming to any of the following grades of steel as specified to each of the works:
IS:2062 : Specification for Structural Steel (Fusion Welding Quality) IS:1977-1975: Structural steel (ordinary quality)
IS:2062-1980: Weld able Structural steel (fusion quality)

Whenever the contractor supplies steel, he shall on demand the test certificates from the manufacturer.

The welding rods used for fabrication shall conform to IS:814-1974 (parts I and II). The fasteners like bolts, nuts etc., shall conform to IS:1367. Rivets shall conform to IS:1184-1982. Plain washers shall conform to IS:2016- 1967. Spring washers shall conform to IS:3063-1972.

MS rivets shall conform to IS:1148 and IS:1929-1967 bolts and nuts shall conform to IS:1363 - 1967.

If metal arc welding is to be done as per design or as ordered by the Engineer in-charge the electrodes used for strength welds shall conform to IS: 814 and shall be of such shape and size approved by the Engineer-in- Charge and shall be prevented from oxidation and shall be kept in clean condition.

Paints used shall be of approved manufacture and shade and shall conform to the ISI standards.

5.7.4 Fabrication and Erection

All the shop drawings shall be prepared by the contractor and submitted in advance of at least 15 days to the Engineer for his approval. The drawings shall be submitted in triplicate. The fabrication work shall not be taken in hand until the shop drawings are approved by the Engineer. Approval of the shop drawings however shall not relieve the contractor of his responsibility of correct conformation to the designs and fabrications of the structure to meet the requirements of the contract. One copy of the approval drawings shall be given to the contractor for going ahead with the fabrication work.

In the shop drawings to be submitted by the contractor, standard symbols as described in the IS:813-1961 shall be followed. Fabrication work shall be carried out as laid down in IS:800-1984 Code of practice for general construction in steel.

Welding shall be carried out in accordance with the following specifications as applicable:

IS:803 - 1976	:	Code of practice for design fabrication and vertical mild steel cylindrical welded oil storage tanks.
IS: 816 - 1969	:	Code of practice for use of metal and welding for general construction in mild steel
IS:822 - 1970	:	Code of practice for manual and welding of mild steel
IS:9595 - 1980	:	Recommendations for metal are welding of carbon Radiographic tests are required to be carried out as directed by the Engineer in case of pressure vessels.
IS:818 - 1968	:	Code of practice for safety and health requirements in electric and gas welding and cutting operations
IS:3016-1982	:	Code of practice for fire precautions in welding and cutting operations
IS:7205 – 1973	:	Safety code for erection of structural steel work

The sections shall be fixed absolutely vertical or to the specified angle as shown in the drawings/as desired/directed by the Engineer.

All connections like angle brackets, cleats, gusset plates, anchor bolts, bearing plates shall all be fixed as shown in the drawings or as directed by the Engineer.

The items of work shall include supply of materials, fabrication and erection in position on site as shown in the drawings. This shall also include all labour consist, materials and equipment required for all fabrication, hoisting, erection, and satisfactory completion of the item of work.

The supply of materials includes all structural members like rolled sections, plates, brackets, rivets, bolts and nuts and welds.

The steelwork shall be painted as specified in the drawings, described in the bill of quantities or as directed by the Engineer. Unless otherwise provided for in the bill of quantities separately, the rate quoted for the item is inclusive of all costs for painting like cost of paint, cost of labour, scaffolding etc. Welding work shall be done generally using electric arcs welding. Where public electricity is not available, generators shall be arranged by the contractor shall be arranged by the contractor himself.

Gas welding shall not be allowed to be resorted to for welding. Under special circumstances if in the opinion of the Engineer it cannot be avoided, gas welding can be done with the prior permission of the Engineer. However gas welding shall not be used where structural strength is the criteria for consideration.

All arrangements shall be made by the contractors for access for inspection by the Engineer or his representative to the workshop where the welding work is being carried out and necessary equipment like gauges, measuring instruments etc., shall be made available to the inspecting personnel.

Painting work shall not be started without the express approval of the Engineer and the painting shall be started only after his inspection and approval of the works after carrying out surface preparations.
All holes shall be carefully marked. Holes shall have their axis perpendicular to the surfaces bored through. Holes being made through two or more members shall be truly concentric. Holes shall not be formed cutting process.

All the temporary connections of parts during assembly shall be done in the following ways. For welded structures. Tack welding fixtures.

After welding is over, the surface on the joint should be ground and made smooth and even. The welding should be so perfect so as to give required strength as taken for designed purpose at joints in particular. The contractor will make necessary arrangements for testing of joints as required by Engineer in Charge. Welded joints shall be free from defects that would impair the service performance of the construction. All the welds shall be free from incomplete penetration, incomplete fusion, slag inclusion, burns, un-welded creators undercuts and cracks in the welded metal, porosity etc. All the defects shall be rectified as directed by the Engineer. Defective portions shall be removed to the sound metal and re- welded. Rectification of the welds by caulking shall not be permitted.

All welds shall be cleaned of stag and other deposits after completion.

5.5 Brick Work and Stone Masonry

These specifications deal with all types of brickwork required for buildings, manholes, drains, retaining walls or any construction made out of bricks.

5.8.1 Relevant IS Codes

IS:1077	:	Common burnt clay building bricks
IS:2180	:	Heavy duty burnt clay-building bricks
IS:2212	:	C.P. for brickwork
IS:3495 (I – IV)	:	Method of test for clay building bricks
IS:5454	:	Method of sampling of clay building bricks

5.8.2 Materials

5.8.2.1 Bricks

Bricks used for the construction of brick masonry shall be sound, hard, rectangular in shape and size and well burnt of uniform deep red, cherry or copper colour and shall conform to IS:1077-1986.

The bricks shall be brought from approved brick kilns. The bricks shall be free from cracks, chippings flaws, stones or lumps of any kind. The bricks shall not show any signs of efflorescence and shall be homogeneous in texture.

They should emit a clear metallic sound on being struck and shall have a minimum compressive strength of 75 kg/sq.cm. They shall not absorb water more than specified in the Indian Standard Specifications, of its dry weight when soaked in cold water for 24 hours.

5.8.2.2 Mortar

The proportion of the cement mortar used for the masonry work shall be as specified on the various drawings for different places/types of construction, bills of quantities, and specifications for each part of the work.

Mortar should be prepared by volume using boxes of appropriate sizes on clean platform or this sheet to avoid mixing of foreign material and maintain consistency of mortar.

Sharp coarse sand is mixed with the required quantity of cement for the preparation of the mortar. Mortar shall be prepared in accordance with IS:22501981. The sand used for the masonry mortar shall meet the requirements as specified in IS:2116-1980. Sand for masonry mortars. Sand and cement of required proportions are mixed in small quantities in a dry state first and then water is added to make the mortar of required the consistency suitable for the type of work it is required as directed by the Engineer-in-charge. No left over mortar shall be used and therefore only that much quantity of mortar that can be consumed within 30 minutes shall be mixed in batches.

5.8.2.3 Construction

The brick masonry shall be constructed as per the Indian Standard Code of Practice for Brick Work - IS: 2212-1962. The thickness of the joints shall not be thicker than those specified in of the above Code of Practice.

The bricks shall be thoroughly soaked in water before using them on the work for at least six hours and all the air bubbles shall come out during soaking process. The soaked bricks shall be stacked on wooden planks/platforms so as to avoid sticking of the earth and other materials on to the surfaces of bricks. Bricks required for construction in mud mortar or lime mortar shall not be soaked. Brickwork shall be laid in English Bond unless otherwise specified. Half bricks shall not be used except when need to complete the bond. Each course shall be perfectly straight and horizontal. The masonry shall be true to plumb in case of vertical walls and in case of battered construction the batter or slope shall be truly maintained. The level of the courses completed shall be checked at every meter interval or less as required.

The bricks shall be laid frogs upwards. While laying the bricks they shall be thoroughly bedded and flushed in mortar and well trapped into position with wooden mallets and superfluous mortar shall be removed.

No part of the structure shall be raised more than one meter above than the rest of the work. In case it is unavoidable the brickwork shall be raked back at an angle of not more than 45 degrees so as to maintain a uniform and effectual bond, but raking shall not start within 60 cms from a corner.

In cases of construction of buttresses, counter forts, returns they are built course by course carefully bound into the main walls. At all junctions of walls the bricks at alternate courses, shall be carried into each of the respective walls so as to thoroughly unite both the walls together. The brickwork shall not be raised more than 14 courses per day.

All the beds and joints shall be normal to the pressures applied upon them
i.e. horizontal in vertical walls, radial in arches and at right angles to the face in battered retaining walls.

Vertical joints in alternate courses shall come directly one over the other and shall be truly vertical. Care shall be taken to ensure that all the joints are fully filled up with mortar, well flushed up where no pointing is proposed, neatly struck as the work proceeds. The joints in faces, which are plastered or painted, shall be squarely raked out to a depth not less than 12 mm while the mortar is still green. The raked joints shall be well brushed to remove the loose particles and the surfaces shall be cleaned with a wire brush so as to remove any splashes of mortar sticking to the surfaces during the construction.

All iron fixtures, pipes, bolts, conduits, sleeves, holdfasts etc., which are required to built into the walls shall be embedded in cement mortar or cement concrete as shown in the drawings/indicated in the specifications directed during the execution by the Engineer-in-charge as the work proceeds and no holes be left for fixing them at a later date unless authorized by the Engineer-in-Charge.

5.8.2.4 Curing Fresh work shall be protected from rain by covering the work suitably. Masonry work as it progresses shall be thoroughly kept wet by watering on all the faces for atleast 7 (Seven) days after completion of the parts of the work. Proper watering cans, flexible pipes, nozzles shall be used for the purpose. The top of the masonry work shall be kept flooded at the close of the day's work by constructing fillets of mortar 40 mm high all around the edges of the top course. In case of fat lime mortar curing shall start two days after construction of masonry and shall continue for seven days. No additional payment is admissible for curing and the rates quoted are deemed to be inclusive of the cost of curing.

5.8.2.5 Scaffolding

Double scaffolding sufficiently strong so as to withstand all loads that are likely to come upon it and having two sets of vertical supports shall be provided. Where two sets of vertical supports are not possible the inner end of the horizontal supporting pole shall rest in a hole provided in a header course only. Only one header for each pole shall be left cut. Such holes, however shall not be permitted in pillars under one meter in width or immediately near the skewbacks of arches. Such holes shall be filled up immediately after removal of the scaffoldings. Safety Code for Scaffolds and Ladders, IS:3696-1987 (Parts I and II) shall be followed. The cost of scaffolding is deemed to be included in the rates quoted for brick masonry and no separate costs are payable.

5.8.3 Stone Masonry for Retaining Walls

Stone masonry in general is to be used for retaining walls as per engineer in charge's instructions and as per drawings, which will be supplied during course of construction to suit site conditions.

Following Indian Standards shall be applicable:

IS:11221974	Methods of determination of specific gravity and porosity of natural building stones
IS:1200	Method of measurement of stone masonry.
IS:1597	Code of practice of construction of rubble stone masonry.
IS:1805	Glossary of terms relating to stone quarrying and dressing
IS:4101	Stone facing
IS:1121	Determination of strength, properties of natural building stones

5.8.3.1 Uncoursed Stone Masonry

Uncoursed stone masonry shall be built in layers not exceeding 450 mm in height. No stone shall be less in breadth than 14 times its height and less in length than twice its height. Every stone whether large or small, shall be laid in its natural bed and set flush in mortar, and the small stones used for wedging or filling being carefully selected to fit the interstices between the large stones. Care shall be taken to see that no dry work or hollow space is left in the masonry. The stones shall be so arranged as to break joints at least every 80 mm and long vertical joints of joints shall be avoided. The joints at the face shall be finished off neatly, being struck and smoothed with a trowel while the mortar is fresh. The upper surface of the work shall be brought to a uniform level at the height of each course. The faces of masonry walls shall be kept in perfect plumb and where batter has to be given it shall, be uniform. The stones at all comers and junctions of walls shall be of large sizes and hammer dressed to the correct angle.

Each stone shall be thoroughly wetted before being used in the work. The masonry shall be kept thoroughly wet during the progress of the work, (care being taken to water it even on Sundays and Holidays, special labour being employed if so required for this purpose) until it becomes hard. As far as practicable, the whole of the masonry shall be raised in one uniform level and no part of the masonry shall he allowed to rise more than 1 meter above the rest to avoid unequal settlement. If raising one part of wall before the other becomes unavoidable the end of the raised portion shall be racked back in steps to prevent cracks developing at the junction of the old and new work. Care shall be taken to see that the sides of the wall are not built separately from the hearting, the faces and internal filling being done simultaneously .The stones shall overlap and cross each other as much as possible. No course shall be laid unless the previous course is perfectly set.

Al least one header or through stone per square meter of` wall face shall be built into the work. The headers or through stones shall be at least 0.05 m in area al face and shall have at least 0.025 m area at the back face. Where the thickness of the wall is more than 600 mm a series of through stones shall be laid through the work so as to form a tie from front to back, breaking joints or overlapping each other for at least 150 mm. No stone whose length is less than 600 mm shall be used in such work as a header.

All the through stones shall be marked inside and outside and the marks shall be retained until ordered by the Engineer to be removed. Sufficient number of headers shall be collected on site before commencing any masonry work. Where adequate sized through stones are not available in required quantities, the use of pre-cast plain concrete headers in M-20 mix may be permitted at the discretion of the Engineer. No extra payment will be made for the provision of substitute headers in concrete

Quoins shall be 150 mm high and formed of header stones at least 300 mm long. They shall he laid lengthwise alternately along each face and square on their beds, which shall be dressed to a depth of at least 80 mm. Weep holes 80 mm wide and 150 mm in height shall be provided in retaining walls at the rate of one per square meter as specified or directed. They shall he pointed with 1:2 cement sand mortar after raking the joints to a minimum depth of 25 mm.

Completed masonry shall be kept wet for a minimum period of 14 days. In wet weather newly laid masonry shall be protected from the effects of heavy rainfall by tarpaulins or other approved material.

5.8.3.2 Pointing of Uncoursed Masonry

Joints in exposed masonry faces shall be formed while the mortar is still green and shall be finished as flush joints, weathered joints, round- recessed joints or square-recessed joints as directed by he Engineer. Masonry which is to be rendered or plastered shall have the joints raked out to a depth of 15 mm to form a key.

5.8.3.3 Stone Pitching

Stone pitching: to slopes shall be carried out where specified or as directed by the Engineer. Stone for pitching shall be obtained from an approved source and shall be hard, sound, durable, clean and generally as specified. The minimum dimension of any stone shall be, at least equal to the specified thickness of the pitching.

After excavation and trimming, slopes to be pitched shall be spread with a 75mm thick layer of crusher run rock or graded coarse aggregate ranging from 75mm particle size to fines. The slope shall then be hand packed with hard broken rock to a total thickness of 150 mm, each stone being individually placed and rammed home, with smaller stones edged into the cracks. 50mm dia weep-holes shall be provided where specified at intervals not exceeding two meter's in both directions. Joints in stone pitching shall be flushed up with sand/cement mortar on completion.

5.8.3.4 Rubble Packing

Rubble used for packing under floors, foundations, etc. shall be hard and durable rock, free from veins, flaws and other defects. The quality and size of the rubble shall be subject to the approval of the Engineer.

Rubble shall be hand packed as directed by the Engineer. They shall be laid closely in position on the sub-grade. All interstices between the stones shall be wedged in with smaller stones of suitable size well driven to ensure tight packing and complete filling of interstices. Such filling shall be carried out simultaneously with the placing in position of rubble stones and shall not lag behind. Small interstices shall be filled with hard clean sand and well watered and rammed.

5.8.4 Concrete Block Masonry

5.8.4.1 Materials

Masonry units of hollow and solid concrete blocks shall conform to the requirements of IS : 2185 (Part I).

Masonry units of hollow and solid light-weight concrete blocks shall conform to the requirements of IS:2185(Part 3).

Masonry units of autoclaved cellular concrete blocks shall conform to the requirements of IS:2l85(Part 3).

The height of the concrete masonry units shall not exceed either its length or six times its width.

The nominal dimensions of concrete block shall be as under. Length 400, 500 or 600 mm
Height 100 or 200 mm
Width 100 to 300 mm in 50 mm increments

Half blocks shall be in lengths of 200, 250 or 300mm to correspond to the full length blocks. Actual dimensions shall be 10mm short of the nominal dimensions.

The maximum variation in the length of the units shall not be more than 5 mm and maximum variation In height or width of the units shall not be more than 3mm.

Concrete blocks shall be either hollow blocks with open or closed cavities or solid blocks.

Concrete blocks shall be sound, free of cracks, chipping or other defects, which impair the strength or performance of the construction. Surface texture shall as specified. The faces of the units shall be flat and rectangular, opposite faces shall be parallel and all arises shall be square. The bedding surfaces shall be at right angles to the faces of the block.

The concrete mix for the hollow and solid concrete blocks/light weight concrete blocks shall not be richer than one part of cement to six parts of combined aggregates by volume. Concrete blocks shall be of approved manufacture, which satisfy the limitations in the values of water absorption, drying shrinkage and moisture movement, as specified for the type of block as per relevant IS code. Contractor shall furnish the test certificates and also supply the samples for the approval of Engineer In Charge.

5.8.4.2 Workmanship

The type of the concrete block, thickness and grade based on the compressive strength for use in load bearing and/or non-load bearing walls shall be as specified. The minimum nominal thickness of non load bearing internal walls shall be 100mm. The minimum nominal thickness of external panel walls in framed construction shall be 200 mm.

The workmanship shall generally conform to the requirements of IS:2572 for concrete block masonry, IS:6042 for light weight concrete block masonry and 15:6041 for autoclaved cellular concrete block masonry works.

From considerations of durability, generally concrete block masonry shall be used in superstructure works above the damp-proof course level.

Concrete blocks shall be embedded with a mortar, which is relatively weaker than the mix of the blocks in order to avoid the formation of cracks. Cement mortar of proportion 1:6 shall be used for the works.

The thickness of both horizontal and vertical joints shall be 10mm. The first course shall be laid with greater care, ensuring that it is properly aligned, leveled and plumb since this will facilitate in laying succeeding courses to obtain a straight and truly vertical wall. For the horizontal (bedding) joint, mortar shall be spread over the entire top surface of the block including front and rear shells as well as the webs to a uniform layer of 10mm. For vertical joints, the mortar shall be applied on the vertical edges of the front and rear shells of the blocks. The mortar may be applied either to the unit already placed on the wall or on the edges of the succeeding unit when it is standing vertically and then placing it horizontally, well pressed against the previously laid unit to produce a compacted vertical joint. In case of two cellblocks with slight depression on the vertical sides these shall also be filled up with mortar to secure greater lateral rigidity. To assure satisfactory bond, mortar shall not be spread too far ahead of actual laying of the block as the mortar will stiffen and lose its plasticity. Mortar while hardening shrinks slightly and thus pulls away from the edges of the block. The mortar shall be pressed against the units with a jointing tool after it has stiffened to

effect intimate contact between the mortar and the unit to obtain a weather tight joint. The mortar shall be raked to a depth of 10mm as each course is laid to ensure good bond for the plaster. Dimensional stability of hollow concrete blocks is greatly affected by variations of moisture content in the units. Only well dried blocks should be used for the construction. Blocks with moisture content more than 25% of' maximum water absorption permissible shall not be used. The blocks should not be wetted before or during laying in the walls. Blocks should be laid dry except slightly moistening their surfaces on which mortar is to be applied to obviate absorption of water from the mortar.

As per the design requirements and to effectively control cracks in the masonry, RCC bound beam/studs, joint reinforcement shall be provided at suitable locations. Joint reinforcement shall be fabricated either from mild steel wires conforming to IS:280 or welded wire fabric/high strength deformed basis.

For jambs of doors, windows and openings, should concrete blocks shall be provided. If hollow units are used, the hollows shall be filled with concrete of mix 1:3:6. Hold fasts of doors/windows should be arranged so that they occur at block course level.

At Intersection of walls, the courses shall laid up at the same time with a true masonry bond between at least 50% of the concrete blocks.

Curing of the mortar joints shall be carried out for at least 7 days. The walls should only be lightly moistened and shall not be allowed to become excessively wet.

Double scaffolding shall be adopted for execution of block masonry work.

Cutting of the units shall be restricted to a minimum. All horizontal and vertical dimensions shall be in respectively, adopting modular co- ordination for walls, opening locations for doors, windows etc.

Concrete blocks shall be stored at site suitably to avoid any contact with moisture from the ground and covered to protect against wetting.

5.8.5 Damp-Proof Course

5.8.5.1 Materials and Workmanship

Where specified, all the walls in a building shall be provided with damp- proof course cover plinth to prevent water from rising up the wall. The damp-proof course shall run without a break throughout the length of the wall even under the door or other openings. Damp-proof course shall consist of 50 mm thick cement concrete of 1:2:1 nominal mix with approved water-proofing compound admixture confirming to IS: 2645 in proportion as directed by the manufacturer. Concrete shall be with 10 mm down graded coarse aggregates.

If he surface of brickwork/stone masonry work shall be leveled and prepared before laying the cement concrete. Side shuttering shall be properly fixed to ensure that slurry does not leak through and is also not disturbed during compaction. The upper and side surface shall be made rough to afford key to the masonry above and to the plaster.
Damp-proof course shall be cured properly for at least seven days after which it shall be allowed to dry for taking up further work.

5.6 Plastering

5.8.9.1 Relevant IS Codes

IS:1542	:	Sand for plaster
IS:1661	:	C.P. for application of ferrous metals in building
IS:2394	:	C.P. for application of lime plaster finish

5.8.9.2 Plastering

Cement mortar used for plastering shall be of the mix proportions and thickness as specified on the drawings or bill of quantities or particular specifications for the various different parts of the works.

The materials used i.e. cement, sand and water shall be of the same quality and of the same specifications as indicated for plain and reinforced cement concrete works in the Section D2 of this tender.

Sand further shall meet the specifications as laid down in IS:1542-1977 Specification for sand for plaster.

The surfaces that are to be applied with plaster shall be thoroughly cleaned to remove dust, dirt, loose particles, oil, soil, slats etc. that may be sticking to the surfaces. The surfaces shall be washed clean and watered properly for 4 hours before applying plaster.

Plaster shall not, in any case, be thinner than specified. It shall have uniform specified thickness. When smooth finishing is required the cement plastering shall be floated over with neat cement within 15 minutes after application of the last coat of plastering.

The plaster shall be protected from the sun and rain by such means as the Engineer-in-charge in charge may approve. The plastered surfaces shall be cured for 7 (seven) days. Construction joints in plastering shall be kept at places approved by the Engineer-in-Charge. When the thickness of the plaster specified is to be made up in more than one layer, the second layer shall be applied only when the lower coat is still green. After applying the first layer the surface should be roughed and wherever specified, approved brands of additives like water proofing compounds shall be added in specified quantities as recommended by the manufacturer of the compound, or as directed by the Engineer-in-Charge.

Wherever scaffolds are necessary for plastering they shall be provided. Stage scaffolding shall be provided for ceiling plaster. To ensure even thickness and true surface, patches of plaster about 15 cms x 15 cms shall be first applied both horizontally as vertically 2 m apart. Plastering shall be done from top to bottom and care shall be taken to avoid joints on continuous surface.

Sand face plaster shall consist of first layer of 12 mm average thick cement plaster in cement mortar 1: 6 (One part cement and Six parts coarse sand). A second layer of 4 mm average thick in cement mortar 1:4 (one part cement and four part coarse sand) shall be applied. After the application of final coat, the surface shall be finished with the application of sponge rubber or as directed to obtain a uniform sand particle surface finish.

In case any other finish like rough cast finish or dry dash finish is specified in the drawings the same shall be provided as directed by the Engineer-in- Charge. Surfaces, which are to be plastered, shall be roughened while they are still green or raked so as to give proper bond between the surface and plaster.

All corner, edges, junctions shall be truly vertical or horizontal as the case may be and carefully finished. Rounding or chamfering of corners shall be carried out with proper templates to the required size and shapes.

No additional charges for works like scaffolding curing etc. are payable over and above the rates quoted for brickwork. The rates quoted shall be deemed to be inclusive of all such works.

5.8.9.3 Neeru

Neeru shall be made of the best description of lime slaked with fresh water and sifted. The lime to be reduced to fine powder by grinding it on a stone or in a hand mill, with a thick solution of mussalla to be made or as may be desired by the engineer. The neeru thus prepared shall be kept moist until used and the quantity to be prepared at one time shall be such that it can be consumed in eight days.

5.8.9.4 Workmanship

All stone or brick masonry shall be thoroughly wetted and joints raked out to a depth of at least 20mm and walls washed before any plastering is done. The surface shall then rendered with fine sand, to the specified thickness and roughness. The surface shall then be floated or set with a thin coat, 3mm thick of cement and polished, well with a trowel or flat board. The cement mortar shall be used within 30 minutes after it leaves the mixing board or mill. Before any plasterwork is started patches of plaster 150mm x 150mm shall be put on at every 3 meters apart as gauges so as to ensure an even thickness throughout the work. Cement plaster shall be done in even square or strips. Care shall be taken to keep the whole surface thoroughly wetted for at least a week. The finishing surface shall be as specified and directed. If neeru finish is specified then the same shall be applied to the prepared and partially set but somewhat plastic surface with steel trowel to a thickness slightly exceeding 1.5 mm and rubbed down to 1.5mm thickness and polished to a perfectly smooth and even finish working from top to bottom. The surface shall be then colored, if required with 3 coats of white or colour wash for which no extra payment shall be made.

5.7 Valves

5.10.1 Types of Valve and Meters

- Deleted-

5.10.2 General Specifications for Valves

5.10.2.1 Gate (Sluice)Valves

Gate Valves shall be either solid wedge or knife gates unless specifically defined on the drawings.

5.10.2.2 Solid Wedge Gate-Type Sluice Valves 5.10.2.3General

All valves shall be double-flanged. Valves of Indian manufacture and in the size ranging 50mm to 300mm shall conform to BIS 780 and those of size ranging from 350 mm and larger

to BIS:2906. Imported valves shall conform to the relevant British or American Standards. The materials used in construction, the design and all other relevant features shall be such that the valves are entirely suitable for use on sewer/sludge pipelines, force mains and within sewage pumping stations. Valve shall be of suitable pressure rating which shall not be

less than twice the normal operating pressure. PN rating For duty heads below 100 m –PN1.0

For duty heads above 100 m –PN1.6

5.10.2.4 Design

The design of the valves will be such that erosion, cavitation, vibration and head loss (in the fully open position) shall be a minimum external lubrication. The valves should be capable of being opened and closed against working pressure which exceeds the maximum working pressures by 15 percent.

5.10.2.5 Materials

The materials used for the manufacture of each component shall be the best available for the specific purpose and shall not, in any case be inferior to the following:

Cast Iron	:	BIS. 210 Grade 20
Stainless Steel	:	BIS. 1570 Grade, BS 970 Type EN, ASTM A 473.
Gun Metal	:	BIS.1400-LG 2 -C or the equivalent Indian Std
Cast Steel	:	Plain Carbon Steel complying with BIS. 1570 Grade, or BS: 970 Grade 431 S 29.

5.10.2.6 Valve Bodies

a. Castings

The structure of the castings shall be homogeneous and free from non-metallic inclusions and other injurious defects. All surfaces of castings, which are not machined shall be smooth and shall be carefully fettled to remove all foundry irregularities.

b. Forgings

All major stress bearing forgings shall be made to a standard specification, which shall be submitted if required to the Engineer in-charge for approval before work is commenced. Forging shall be subjected to non-destructive tests to detect flaws if any. Forging shall be heat treated for the relief of residual stresses. The name of the maker and particulars of the heat treatment proposed for such forging shall be submitted to the AVSLC. The Engineer-in charge or his inspector may inspect such forging at the place of manufacture with a representative of the Contractor.

c. Workmanship

Workmanship and general finish shall be of first class commercial quality and in accordance with best workshop practice.

All similar items of the valve and their component parts shall be completely interchangeable. Spare parts shall be manufactured from the same materials as the originals and shall fit in place of all similar items.

All parts, which can be worn or damaged by dust shall be totally enclosed in dust proof housings.

Protective coating shall comply with BS 1218 Clause 16, for use in tropics, or BIS 2906, Clause 7.

5.10.2.7 Spindle Details

The spindles shall be of Bronze and to permit the solid wedge gate to be so raised as to permit an unimpeded flow passage through the valve in open position. Where hand wheels are provided the direction of rotation and the words 'OPEN' shall be marked prominently on the upper side. All spindles contacting surfaces in the valve body shall be bushed with gunmetal.

5.10.2.8 Valve Gates

Each face of the gate shall be lined with heavy gunmetal rings, which will match with corresponding rings in the body. The rings shall be force fitted by special fixtures and riveted in the case of valves in the size range 450 mm and larger. When finally assembled, the body and wedge faces shall provide a watertight bearing surface. When shut, the gates shall ride on the body seats, to allow for wear.

5.10.2.9 Operation

The tops of the spindles or gears operated with extension spindles or tee keys shall be provided with caps of dimensions conforming to BIS 2906 Table III. The direction of opening shall be indicated on the caps.

5.10.2.10 Lubrication

At the points where lubrication is needed the Contractor shall furnish full details of the method to be employed. The requirement of the requisite lubricating equipment and lubricants for commissioning and operating and maintaining the valves for one year shall be furnished by the contractor.

5.10.2.11 Spare Parts

One spare spindle and nut shall be supplied under this contract for each group of 10 sluice valves or less of the different sizes. The contractor shall take this into account while quoting the rates for individual items. No separate payment shall be made for this work. In addition the Contractor shall submit a list of recommended spares for 5 years of operation and maintenance of all mechanical, electrical and instrumentation works covered under this contract. Spares supplied shall be new, unused and interchangeable with the corresponding components they are intended to replace.

5.11.1 MILD STEEL WORK

5.11.2.1 All reinforcement shall be clear and free form mill scales, dust, loose rust, coats of paints, oil or other coating which may destroy or reduce bond, it shall be stored in such a way as to avoid distortion and to prevent deterioration and corrosion.

5.11.2.2 Bars shall be bent cold, correctly and accurately to the size and shape as shown on the detailed drawings or as directed by the Engineer. Preferably, bars of full length shall be used. But where this can not be done, overlapping of bars shall be done as directed by the Engineer. The overlapping bars shall be bound together at intervals not exceeding twice the dia of such bars with two strands of annealed steel wire to 0.90 mm to 1.6 mm thickness twisted tight. The over laps shall be staggered for different bars and

located at points along the span where both shear and bending moments are low.

5.11.2.3 Bars shall not be bent or straightened in a manner that will cause permanent damage to the material. Bars with cracks shall not be used. Bars which may be bent or kinked during transport or handling shall be properly straightened before being placed in the work without heating them.

5.11.2.4 The ends of the plain mild steel reinforcement bars shall be bent into U-type having clear diameters equal to four times the diameter of the bar, with a length beyond the bend equal to four times the diameter of bar. Deformed bars may be used without hooks.

5.11.2.5 Reinforcement including lap pages, hooks and length of bar in bends etc. shall be measured in lengths of different diameters, as actually used in the work nearest to a centimeter and their weight calculated on the basis of standard tables. Wastage and un-authorized overlaps shall not be paid for. Annealed steel wire required for binding the reinforcement bars shall not be measured. The rate for mild steel work shall include supply, cutting and bending of mild steel bars to the required shape and size. The rate also include provision of wastage of reinforcement bars as it will not be paid. If the steel is supplied by the department, the bars less than 3 m in length shall not be taken back from the contractor.

5.11.2 DISMANTLING OF ROAD PAVEMENTS

5.11.22.1 The work shall be carried out as per P.W.D. detailed specifications. In case the contractor actually excavates the trenches of less width than the maximum limit of width, the actual width shall be measured for payment of dismantling of road surface.

5.11.22.2 The contractor shall sort out the serviceable road materials and shall properly stack it within a distance of 50 meters as per direction of the Engineer and hand it over to the department of to municipal board authorities as instructed. The unserviceable materials found during the dismantling off road and pavements after sorting out the dismantled materials, shall be disposed off as the surplus materials within a distance of 50 m from the center of the trenches as per direction of Engineer. In certain reaches of the sewer alignment it may not be possible to dispose off the dismantled materials within a distance of 50 m from the center of the trenches, the contractor shall be asked in writing by the Engineer to dispose off the surplus earth at a specified place beyond 50 m distance for which payment to the contractor shall be made under separate item of **Schedule'G'.**

5.11.22.3 If the contractor excavates more width then the required width as specified, the cost of dismantling for this extra width shall not be paid and he reinstatement charges for the road surface at the rates as specified or prevalent in P.W.D. shall be recovered from the contractor. The area of reinstatement of road surfaces in this case shall be taken as the length of dismantling multiplied by the road width dismantled plus 15 cm on either sides to match the reinstatement of old and new surface.

5.11.22.4 The payment against this item shall be made is square meters as per **schedule 'G'**. The thickness of road surfaces to be dismantled shall be considered as mentioned below:-

5.11.22.4.1 BITUMEN ROAD

The thickness of this road shall be taken into account is the thickness of tar coats sub grade only. Soling shall not be measured under this item, which shall be taken in the regular item of excavation.

5.11.22.4.2 CEMENT CONCRETEROAD

The thickness of this type of road shall considered as the thickness of cement concrete slabs and the sub-grade only.

5.11.22.4.3 KANKAR ROAD AND B.O.E. OR FLAT BRICKPAVEMENT

The thickness of these roads shall be considered in accordance with the thickness of B.O.E. or flat brick as the case may be.

5.11.3 The measurement of excavation trenches will be done from the top of surface of road but the deduction in depth of trenches shall be made for the thickness of road pavement.

5.11.4 DISPOSAL OF SURPLUS EARTH

5.11.24.1 If the earth is found surplus for which the disposal is required beyond 50 m from the center of the trench, it shall be disposed off upto 2.0 Km beyond 50 m lead already accounted for in the item of excavation and shall be paid separately against the item of Schedule 'G' This work is to be carried out as per direction and written orders of carrying out the work by the Engineer. The surplus earth of materials shall be spread uniformly, rammed and dressed. The surplus earth shall not be the property of the contractor.

5.11.5 SUNDRYITEM

5.11.25.11. Other item of works not specifically mentioned here in, may be necessary for the due and proper completion of the work. Such items although not specifically mentioned in this tender shall be covered by I.S.S. Earst which L.S.G.E.D., Jal Nigam and P.W.D. detailed specifications where applicable and these shall be deemed to be incorporated in this contract.

5.11.26.1. GENERAL

The contractors are advised to inspect the site of works before filling in their rates. They should form a clear idea of the difficulties likely to be met during the execution of works as payment shall be made for complete portions of the work only and no extra claim on this account shall be entertained.

5.11.26.2. The contractors are also advised to study the drawings and specifications given in the tender in detail before filling in their rates. If there is any discrepancy in the specifications as shown in drawings and detailed specifications as mentioned in writing elsewhere in the tender, they should bring it in clarified prior to tendering their rates.

5.11.6 MANHOLE

5.11.27.1. At every change of alignment, gradient or dia. of sewer, circular manhole shall be constructed as per dimensions and specifications as shown in the drawing. The sizes of the manholes for different depths of sewer shall be kept as under as per IS: 4111 (part-I) –1986.

Depth of Sewer	Inner dia. of circular Manholes
For depth upto 1.65 M	0.90 M
For depth above 1.65 M &upto 2.30 M	1.20 M
For depth above 2.30 M and upto 9.00 M	1.50 M

The size of manhole specified above shall indicate the inside dimensions of the manholes.

5.11.27.2. The manhole shall be excavated true to the dimensions and levels as per requirement. The extra excavations shall be done to facilitate the plastering work on outer side o the manhole. The manhole shall not be paid extra over regular length of the sewers i.e. excavations of sewer line shall be measured from the inner face of the wall of one manhole to the other. Earth work in excavation, refilling between trench and sides of manhole wall duly watered and reamed and disposal of surplus earth upto a distance of 50 m from the center of the trench shall be included in the rate of manhole and this shall not be measured and paid extra s per item no. '1' of Schedule'G'.

5.11.27.3. Manhole shall be constructed in first class brick work in cement mortar 1:5 (one part cement and five parts coarse sand). The foundation concrete shall be cement concrete 1:4:8 (one part cement, 4 parts coarse sand, 8 parts 20 mm nominal gauge stone aggregate). The thickness of bed concrete for manholes upto2.30mdepthbelowgroundlevelshallbe22.50cmanfor the manholes having depth more than 2.30 m it shall be 30 cm. Projection of bed concrete beyond the masonry wall shall be 15 cm. The inside an outside of walls shall be plastered with 12mm thick cement mortar 1:3 with coarse sand finished smooth, with a coat of neat cement.

5.11.27.4. Channels shall be semi-circular in the bottom half and of diameter equal to the sewer. Above the horizontal dia meter, the sides shall be extended vertically 50mm above the crown of sewer. Pipe and the top edge of the channel shall be suitably rounded off. The channels and benching shall be done in cement concrete 1:2:4 (one cement, 2 coarse sand 4 graded stone aggregate 20 mm nominal gauge) and rendered smooth with neat cement. The rendered surface shall have a hard impervious finish obtained by using a steel trowel.

5.11.27.5. P.V.C footsteps to be supplied by the department as per Schedule 'I' shall be provided in all manholes over 0.80 meter in depth. These footsteps shall be set staggered in two vertical runs which shall be 300mm a part horizontally. The top footstep shall be 450 mm below the manhole cover and the lowest not more than 300 mm. The footsteps shall project a minimum of 100 mm beyond the finished surface of the manhole wall.

5.11.27.6. Slab type a manhole shall be constructed upto a depth of 3 m below ground level. Cover slab of such type of manholes shall be of R.C.C. 1:2:4 (one cement, 2 coarse sand and 4 graded stone aggregate 20 mm nominal gauge) 150 mm thick reinforced with 12 mm bars at 20 cm centre both ways, surface and edges finished fair. Full bearing equal to the width of the wall shall be given to the slab on all sides. The frame of the manhole cover shall be embedded firmly in the side or the center of R.C.C. slab so that top of the frame remains flush with the top of the R.C.C. slab and road surface. A beam of size 15 cm × 15 cm shall be provided all round the manhole cover fame and if the fame is to be fixed in the center bars with 8 mm dia two legged stirrups at this beam. Manhole cover shall be fixed in the side of the manhole where the incoming and outgoing sewer is in straight line. 2 nos. 12 mm dia steel bars shall be placed around the manhole cover frame if it is fixed in the side.

5.11.27.7. If the difference in level between the incoming and outgoing sewer does not exceed 600mm and there is sufficient room in the manhole, the incoming sewer shall be directly brought through the manhole wall and the fall accommodated by constructing a ramp in the benching of the manhole. For this arrangement, wherever required, no extra payment to the contractor shall be made. If the difference in levels between the incoming and outgoing sewer is more than 600mm, then the connection shall be made by constructing a drop manhole i.e. a vertical shaft outside the manhole chamber shall be constructed as shown in the drawing attached with this tender.

5.11.27.8. The excavation of drop type manhole shall be carried upto the bed concrete of the manhole and for the vertical shaft if shall be done to the full width of the sewer line.

5.11.27.9. Ferro-cement circular manhole cover of 560 mm dia size, heavy duty shall be supplied by the department free of cost as per Schedule 'I' contractor shall be required to fix ferro-cement manholes cover with frame as per direction of the Engineer.

5.11.27.10. The adjustment for more or less depth than 3 m below ground level shall be done in the lower most section of the manhole and shall be paid against separate item of Schedule'G'.

5.11.27.11. The measurement of manholes shall be done as a complete item in number. The regulation of depth of manhole shall be measured in vertical depth in meters less than 3 m or more than 3 m as the case maybe.

5.11.27.12. The rate of manhole shall include the rate to construct complete manhole of required size and depth including supply of all labour, materials, T&P etc. (manhole cover, foot steps, S.C.I. pipe & specials to be supplied by the department free of cost), including the cost of excavation & refilling the trenches & timbering if required and disposal of surplus earth upto a distance of 50 m from trenches. The rate for regulation of depth shall include the supply of all materials (Except the materials supplied by the department free of cost as per Schedule 'I'), labour T&P etc. required to complete the work.

5.11.7 APPROVEDMAKES

5.11.28.1. Civil works

	MATERIAL, WORK	SUPPLIER, MANUFACTURER, VENDOR, AGENCY
	Cement OPC	Ultratech, Gujrat Ambuja, Vikram, Coramandel, Birla Super, JK, Prism, JP, Birla
	Cement (SRC)	ACC, Gujrat Sidhee, Gujrat Ambuja
	Cement (White)	Birla, JK
	Cement (PPC)	ACC, Gujrat Sidhee
	Bricks	Ordinary Burnt Clay Bricks of any brand conforming to IS: 1877 with minimum Crushing Strength of 40 Kg/cm^2 and Water Absorption Ratio restricted to 25% for Bricks used in Panel Walls and 20% for Bricks used in Load Bearing Walls
	Mild, Tor Steel, CRS Steel	TISCO, SAIL, Vizag, RINL
	Structural Steel	SAIL, TISCO, Vizag
	Screws	GKW Nattlefold, Oxidised
	Dash Bolt Fasteners	Fischer, Hilti

	Ceramic Tiles	Kajaria, Nitco, Johnsons
	Glazed Tiles (1st Quality)	H & R Johnson, Kajaria,
	Granite Tiles	Bell Granito, H & R Johnson, RAK Ceramics – Dubai, Restile Ceramic
	Glass Mosaic Tiles	Bisazza India, PinoBisazza
	Paver Blocks	Conwood Prefab, Hindustan Prefab or equivalent
	Adhesives	Pidilite, Fairmate, Bal Adhesive, MC Bauchemie, Cementone India, Fosrock, Sunanda Speciality Coating
	MS Door Frames & Shutters (With Galvanising)	Agew, Ferrosteel, SenHarvic, Weldoors, Yashashri Polyextrusion
	Door Shutters (Wooden)	Kutty, Anchor, Classic, Goyal, Timber Techniks, Sejpal Doors, Wood Designs, Yashashri Polyextrusion, Anand Wood Crafts, Northern Doors
	Door Shutters (FRP) & Plastic	Everest fibre glass Industries, Unipals India, Advance Marketing, Yashashri Polyextrusion, Sintex
	Hardware (Handles, Hinges, Mortice Locks)	Shalimar, Sobeet, Vijayan, Navbharat Brass Works, CIEF, AmarbhoyDossaji
	Aluminium Windows	Aluminite, Aluplex, Almech, Indrajit Associates, Aldoweit, Crystal Corporation, Indal, Jindal, Ajit India
	Night Latch	Godrej, Sobeet, Vijayan, Yale
	Paints:	
	a. Internal	Snowcem, Asian, ICI, British Paints, Shalimar, Nerolac, Burger, Jenson & Nicholson
	b.External	NITCO Paints, Killick Nixon, Hindustan Colours and Chemicals, Supreme, Shalimar, Burger, Jenson & Nicholson, Super Snowcem.
	MATERIAL, WORK	**SUPPLIER, MANUFACTURER, VENDOR, AGENCY**

	Synthetic Plaster Finish	Nitco, Accro, Damani Dye Stuff, Supreme, Renova
	Waterproofing Works	India Waterproofing Co., Likproof India, Overseas Waterproofing Co.
	Waterproofing Compound	Accoproof, Pediproof, CICO, Impermo, Vamiplas 302, Vamiproof 101 & 102
	Glazing	Float Glass of Modi , Asahi , Saint Gobain
	M.S. Rolling Shutters (With Galvanising)	Swastik, Standard, Shudwar
	Aluminum Grills	DECO, Alumni grille
	Aluminum Joinery	Crystal Corporation, Alumlite, Aluplex, Alm
	Anti-stripping Agent	Yuva, BE 100
	Chemical Admixtures and Compounds for RCC and Mortar	MC Bauchemie, Krishna Conchem Products, Sunanda Chemicals, Pidilite, Fairmate, Fosroc, Sika Qualcrete
	Anti-Corrosive Paint	Krishna Conchem Products, CICO Chemisol Adhesive, Shalimar, Burger
	Sanitary ware	Hindustan, Parry, Cera, John Gas, Jotisum
	Flushing Cistern	Flush Line or equivalent Approved ISI Manufacturers
	Sanitary Fittings and Fixtures	Mark, Jaguar, Gem, Dripless, Kingston, Essco, Metro, EssEss
	Lead for Lead Joints	Approved ISI Manufacturers
	Rubber Ring	Approved ISI Manufacturers
	Stainless Steel Sink	Nirali, Tuff, Diamond, Kingston, Neel Kamal
	SW Gully Trap and Stone ware Pipes	Perfect, Sonya, Girco, Elecon, Rajura
	Cast Iron Covers	RIFCO, Mohit Steel, Ashok Iron Works, JayswalNeco
	Piling Works	Kvaerner, Afcons, Michigan Engineering, Larsen & Toubro, DBM Geotechnics, Meher Foundations, Safe Foundations, Simplex
	Fire-fighting Works	Monsher, Mather & Platt, Bells Controls, Nitin Fire, Rahul Fire

	Elevators	Otis, Mitsubishi, Kone, Bharat Bijlee, Schindler
	Sodium Nitrate	Devica Chemicals or equivalent Approved ISI Manufacturers
	Sodium Silicate	Devica Chemicals or equivalent Approved ISI Manufacturers
	Marine Plywood	Anchor, Kitply
	Neeru	Swastic Instant Neeru or equivalent Approved ISI Manufacturers
	Lime for Whitewash	As directed by Engineer-in-charge
	Tarfelt	Shalimar, Lloyds
	Lightening Conductor	Approved ISI Manufacturers
	Teak Wood	C.P. Teakwood, First Quality with following Tolerances. Sap Wood to the extent of 25%
		Wrap to the extent of 10 mm in 3m Knots/meter
52	D.I. Pipes	Jindal star,Electro steel,Tata,or equivalent pipe as per ISI specification
53	CI Soil Pipes & Fittings as per IS : 3989/84	NECO, CENTRI
54	G.I. Pipes Class “C”	TATA, Zenith, Jindal, Suryaprakash
55	G.I. Fittings	Approved ISI Manufacturers
56	Gate Valve / Non Return Valve	Sant, Zoloto, Leader
57	S.W. Pipes	Rajura or other Approved ISI Manufacturers
58	Flush Valve	Jaguar , EssEss
59	Water Meter	Capstan or other Approved ISI Manufacturers

Note: Drawings are being uploaded separately along with this RFP

Section VI - General Conditions of Contract

The Conditions of Contract, read in conjunction with Special Conditions of Contract and other documents listed therein, should be a complete document expressing fairly the rights and obligations of both parties.

The form of Conditions of Contract that follows has been developed for smaller measurements contracts for construction on the basis of the practice of the Government of India, and considerable experience in different States in India in the drafting and management of contracts, bearing in mind a trend in the construction industry towards simpler, more straightforward language.

GENERAL CONDITIONS OF CONTRACT

i.General

In this Agreement, unless it be repugnant to the context herein or the subject otherwise requires, these words and expressions defined below shall have the meanings assigned to them:

1. Definitions	(a) The **Accepted Contract Amount** shall mean and include the amount accepted in the Letter of Acceptance/Award for the execution and completion of the works and remedying any defects in accordance with the terms of the Agreement. (b) **"Applicable Laws"** shall mean and include all laws which are applicable to the Project and/or to the Contractor extending to the State of Uttarakhand, having been enacted or brought into force by Government of India or Government of Uttarakhand including, notifications, orders, instruments, regulations and rules made thereunder and judgments, decrees, injunctions, writs and orders of any Court or Tribunal or Authority or Forum, as for the time being in force during the subsistence of this RFP. (c) **Bill of Quantities** shall mean and include the priced and completed Bill of Quantities forming part of the Bid. (d) **Compensation Events** shall mean and include those defined in the Clause 42 of the GCC. (e) The **Competent Authority** shall mean and include the DSCL or its Chief Executive Officer or the Additional Chief Executive Officer or anybody or committee or entity constituted or any person or entity or body or committee delegated with specified limited power for specific limited purpose by the Chief Executive Officer of the employer. (f) The **Completion Date** shall mean and include the date of completion of the works as certified and declared by the DSCL or 6 months for construction work period from the date of signing of contract, whichever is later, in addition to and 5 years for operation and maintenance after the expiry of such construction work period. (g) The **Contract** shall mean this Contract Agreement, between the Employer and the Contractor to execute, complete and maintain the works and the documents listed in sub-clause 2.3 of the GCC. (h) The **Contractor** shall mean the party whose bid to carry out the works has been accepted by the Employer and the men, agents, servants, directors, managers, consultants, sub-consultants, officers, staffs of the party whose bid has been accepted by the employer. (i) The **Contractor's Bid** shall mean and include the completed bidding documents submitted by the Contractor to the Employer.

(j) The **Contract Price** shall mean and include the price stated in the Letter of Acceptance and thereafter as adjusted in accordance with the provisions of the Contract.

(k) **Days** are calendar days; **months** are calendar months.

(l) **Defect** shall mean and include any part of the works not completed or not performed or not done in accordance with the contract.

(m) The **Defects Liability Certificate** shall mean and include the certificate issued by Employer, after the Defect Liability Period has ended and upon correction of defects by the Contractor after the expiry of the Completion date.

(n) The **Defects Liability Period** shall mean and include the date on which the Defects Liability Certificate.

(o) **Drawings** shall mean and include the drawings of the works but not limited to the Contract, and any additional and modified drawings issued by or on behalf of the Employer in accordance with the Contract or instruction of the Competent Authority in writing or the Engineer-In-Charge and shall be deemed to include the figures, calculations, other information, facts, images, representations, graphical or otherwise provided or approved for the execution of the Contract.

(p) **"DSCL"** shall mean and Dehradun Smart City Limited.

(q) The **Employer** shall mean Dehradun Smart City Limited or DSCL and any of its officer, men, agents, servants, directors, managers, consultant and sub consultant as has been referred throughout this document.

(r) **Engineer** shall mean the person appointed by the Employer and responsible for supervising the execution of the Works and administering the Contract and all acts incidental as well as consequential for the proper execution of the work for which he is appointed by the employer in accordance with the terms and conditions of such appointment and who shall be treated as the Engineer-In-Charge (E in C) for the purposes of this project.

(s) **Equipment** shall mean Contractor's machinery and vehicles brought temporarily to the Site work.

(t) **"Force Majeure"** or **"Force Majeure Event"** shall mean acts, events, conditions and/or occurrences as specified in the GCC 61.

(u) "**In writing**" or "written" shall mean hand-written, type-written, printed or electronically made, resulting in a permanent record;

(v) The **Initial Contract Price** shall mean the Contract Price listed In the Employer's Letter of Acceptance/Award.

(w) The **Intended Completion Date** shall mean the date on which it is agreed by the parties that the Contractor shall complete the works as per **PCC** including date approved by the Engineer-in charge by issuing an extension of time or an acceleration order in writing.

(x) **Materials** shall mean all supplies, including consumables, used by the Contractor for incorporation in the work.

(y) The **Particular Condition of Contract** shall mean the documents and other information, which comprise the Contract, specifying.

(z) **Plant** shall mean any integral part of the work that shall have equipment's, mechanical, electrical, chemical, function, tools, machineries and shall include site area, land area where such things are lying and operating.

(aa) **PMC shall mean** the project management consultant appointed by Employer for the job as the agreement between the employer and the PMC. The objective of PMC is specified in GCC63.

(bb) **"RFP" shall mean** Request for Proposal document issued by DSCL, including all **"Tender Documents"** and "**Bidding Documents"**.

(cc) The **Site** shall mean the area defined as such in the PCC.

(dd) **Site Investigation Reports** shall mean those that were included in the bidding document and are factual and Interpretative reports about the surface and subsurface conditions at the Site.

(ee) **Specification** shall mean the specification of the works included in the Contract and any modification or addition made or approved by the Engineer-in charge the Competent Authority, as the case may be.

(ff) The **Start Date** shall mean date given in the PCC which shall be latest date by when the Contractor shall commence execution of the works.

(gg) **Subcontractor** shall mean 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.

(hh) **"Tax"** shall mean all tax, duty, and levy, charge whatsoever charged, imposed or levied under Applicable Laws. Payable/ leviable in respect of the said Project.

	(ii) **Temporary Works** shall mean works designed, constructed, installed, and removed by the Contractor that are needed for construction or Installation of the works. (jj) **"Tender/ Bid/"** shall means the Contractor's quoted Technical and/or Financial Proposal and detailed Proposal for the Project including the Contractor's Proposal, submitted to the Employer and as accepted by the ultimately Employer. (kk) **"Termination Date"** shall mean the date on which this Contract Agreement terminates by efflux of time or by issuance of a Termination Notice. (ll) **"Termination Notice"** shall mean the communication received issued in accordance with this Contract Agreement by a Party to the other Party for terminating this Contract Agreement. (mm) **"Termination Payment"** shall mean the amount payable by the Employer to the Contractor upon the termination of this Contract Agreement. (nn) "**Third Party**" shall mean any Person, real or judicial, or entity other than the Parties to this Contract Agreement. (oo) **"Transfer Date"** shall mean the day immediately following the last day of the Contract Period, including any extensions thereto or earlier termination thereof in accordance with the terms of the Concession Agreement. (pp) **"Variation"** shall mean a modification, improvement or change in the works, services, and facilities etc to be carried out by the Contractor, such that the cost of implementing the modification, improvement or change can be recovered through a 30-day adjustment of the Contract Period. (qq) **"Works"** shall mean the Works as defined in the PCC (rr) " **Parties**: DSCL/Employer and Contractor hereinafter individually shall be referred to as a 'Party' and collectively as 'Parties' "
2. Interpretation	2.1 In interpreting these GCC, words indicating one gender include all genders. Words indicating the singular also include the plural and words indicating the plural also include the singular. Headings have no significance. Words have their normal meaning under the language of the Contract unless specifically defined. The Engineer shall provide Instructions clarifying queries about these GCC. 2.2 If sectional completion is **specified In the PCC**, references In the GCC to the Works, the Completion Date, and the Intended Completion Date apply to any Section of the Works (other than references to the Completion Date and Intended Completion Date for the whole of the Works). 2.3 The documents forming the Contract shall be Interpreted In the following

	order of priority: (a) Contract Agreement, (b) Letter of Award, (c) Contractor's Bid & Original Price Bid BOQ, (d) General Conditions of Contract, (e) Particular Conditions of Contract, (f) Specifications, (g) Drawings, (h) Any other document **listed In the PCC** as forming part of the Contract.
3. Language and Law	3.1 The language of the Contract and the law governing the Contract are **stated In the PCC**.
4. Engineer's Decisions	4.1 Except where otherwise specifically stated, the Engineer shall decide contractual matters between the Employer and the Contractor In the role representing the Employer.
5. Delegation	5.1 Unless otherwise **specified In the PCC,** the Engineer may delegate any of his duties and responsibilities to other people, except to the Adjudicator, after notifying the Contractor, and may revoke any delegation after notifying the Contractor.
6. Communications	6.1 Communications between parties that are referred to in the Conditions shall be effective only when in writing. A notice shall be effective only when it is delivered
7. Subcontracting	7.1 The contractor may subcontract part of the construction work with the approval of the Employer in writing, upto 25% of the contract price but will not assign the Contract. Subcontracting shall not alter the contractor's obligations. 7.2 Beyond what has been stated in clauses 7.1, if the contractor proposes sub-contracting any part of the work during execution of the works, because of some unforeseen circumstances to enable him to complete the work as per terms of the contract, the Employer will consider the following before according approval: i. The Contractor shall not sub-contract the whole of the works. ii. The Contractor shall not sub-contract any part of the work without prior Consent of the Employer. Any such consent shall not relieve the contractor from any liability or obligation under the contract and he shall be responsible for the acts, defaults and neglects of any his sub-contractor, his agents or workmen as fully as if they were the acts, defaults or neglects of the Contractor, his agents and workmen. 7.3 The Engineer should satisfy himself before recommending to the Employer whether a.The circumstances warrant such sub-contracting: and b. The sub-contractor so proposed for the work possess the experience, qualification and equipment necessary for the job proposed to be entrusted to him in proportion the Quantum of works to be sub- contracted.

8. Other Contractors	8.1 The contractor shall co-operate and share the site with other contractors. Public authority's utilities and the employer between the dates given in the schedule of other contractors, as referred to in the PCC. The contractor shall also provide facilities and services for them as described in the schedule. The employer may modify the schedule of other contractor, and shall notify the contractor of any such modification.
9. Personnel	9.1 The Contractor shall employ for the construction work and routine maintenance the technical personnel named in the Section 3 or other technical persons approved by the Engineer. The Engineer will approve any proposed replacement of technical personnel only if their relevant qualifications and abilities are substantially equal to or better than those of the personnel stated in the Section 3. 9.2 If the Engineer asks the Contractor to remove a person who is a member of the Contractor's staff or 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 Works in the Contract. 9.3 The Contractor shall not employ any retired Gazetted officer who has worked in the Engineering Department of the State Government and has either not completed two years after the date of retirement or has not obtained State Government's permission to employment with the Contractor
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) in so far as they directly affect the execution of the Works in the Employer's country, the risks of war, invasion, act of foreign enemies, rebellion, revolution, insurrection or military or usurped power, civil war, riot commotion or disorder (unless restricted to the Contractor's employees), natural calamities and contamination from any nuclear fuel or nuclear waste or radioactive toxic explosive, or (b) a cause due solely to the design of the Works, other than the Contractor's design.
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, referred to in clause 11.1, are the responsibility of the Contractor.
13. Insurance	13.1 The Contractor shall provide, In the joint names of the Employer and the Contractor, Insurance cover from the Start Date to the end of the complete contractual obligations including the O&M Period. In the amounts and deductibles **stated In the PCC** for the following events which are due to the Contractor's risks: (a) loss of or damage to the Works, Plant, and Materials [which are Incorporated In works];

	(b) loss of or damage to Construction Equipment; (c) loss of or damage to property (except the Works, Plant, Materials, and Equipment) In connection with the Contract; and (d) Personal Injury or death. 13.2 Policies and certificates for Insurance shall be delivered by the Contractor to the Engineer for the Engineer's approval before the Start Date. All such Insurance shall provide for compensation to be payable In Indian Rupees required to rectify the loss or damage Incurred. 13.3 If the Contractor does not provide any of the policies and certificates required, the Employer may affect the Insurance which the Contractor should have provided and recover the premiums the Employer has paid from payments otherwise due to the Contractor or, if no payment is due, the payment of the premiums shall be a debt due. 13.4 Alterations to the terms of an Insurance shall not be made without the approval of the Engineer. 13.5 Both parties shall comply with any conditions of the Insurance policies.
14.Site Data	14.1 The Contractor shall be deemed to have examined any Site Data **referred to In the PCC**, supplemented by any Information available to the Contractor.
15.Queries about the PCC	15.1 The Engineer will clarify queries on the PCC
16. Contractor to Construct the Works	16.1 The Contractor shall construct and Install the Works In accordance with the Specifications and Drawings and as per Instructions of Engineer. 16.2 The contractor shall construct the works with intermediate technology, i.e., by manual means with medium input of machinery required to ensure the quality of works as per specifications. The contactor shall deploy the equipment and machinery as given in Section 3.
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 Engineer, and complete them by the Intended Completion Date.
18.Approval by the Engineer	18.1 The Contractor shall submit Specifications and Drawings showing the proposed Temporary Works to the Engineer, for his approval. 18.2 The Contractor shall be responsible for design of Temporary Works. 18.3 The Engineer'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 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 Engineer before this use.
19.Safety	19.1 The Contractor shall be responsible for the safety of all activities on the Site specified in the Annexure -1 Clause C5.
20.Discoveries	20.1 Anything of historical or other Interest or of significant value unexpectedly discovered on the Site shall be the property of the Employer. The Contractor shall notify the Engineer of such discoveries and carry out the Engineer's Instructions for dealing with them.
21.Possession of the Site	21.1 The Employer shall handover complete or part possession of the site to the Contractor 7 days in advance of construction program. At the start of the work, the employer shall handover the possession of at-least 50% of the site.
22 Access to the Site	22.1 The Contractor shall allow the Engineer and any person authorized by the Engineer access to the Site and to any place where work In connection with the Contract is being carried out or is intended to be carried out.
23 Instructions, Inspections and Audits	23.1 The Contractor shall carry out all Instructions of the Engineer which comply with the applicable laws where the Site is located. 23.2 The Contractor shall keep, and shall make all reasonable efforts to cause its Subcontractors and sub-consultants to keep, accurate and systematic accounts and records In respect of the Works In such form and details as will clearly identify relevant time changes and costs.
24 Appointment of the Arbitrator	The Arbitrator shall be appointed as per the mutual agreement of both the parties.
25 Procedure for Disputes	If any dispute arises out of this Contract with regard to the interpretation, meaning and breach of the terms of the contract or in the work of operation, the matter shall be tried to be resolved amicably by the parties and in case of failure, the same shall be referred to the Sole Arbitrator to be appointed mutually by the parties, whose decision shall be final and binding on the parties. All arbitration proceedings shall be as per Arbitration and Conciliation Act 1996 with its amendments from time to time.The Seat of Arbitration shall be at Dehradun and the Courts at Dehradun alone shall have jurisdiction to entertain any matter arising out of this agreement/contract."

25.1.1 Program	**B. Time Control** 26.1 Within the time stated in the **PCC**, 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 and will submit the detailed drawings of the all of work and same shall be reviewed and approved by Engineer of DSCL or through other agency approved by DSCL. 26.2 The Contractor shall submit the list of equipment and machinery being brought to site, the list of key personnel being deployed, the list of machinery/equipment being placed in field laboratory and the location of field laboratory along with the Program. The Engineer-In charge shall cause these details to be verified at each appropriate stage of the program. 26.3 An update of the Program shall be a program showing the actual progress achieved on each activity and the effect of the progress achieved on the timing of the remaining work, including any changes to the sequence of the activities. 26.4 The Contractor shall submit to the Employer for approval an updated Program at intervals no longer than the period stated in the **PCC.** If the Contractor does not submit an updated Program within this period, the Employer may withhold the amount stated in the **PCC** from the next payment certificate and continue to withhold this amount until the next payment after the date on which the overdue Program has been submitted. In the case of a lump sum contract, the Contractor shall provide an updated Activity Schedule within 14 days of being instructed to by the Engineer. 26.5 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 shall show the effect of Variations and Compensation Events.
25.1.2 Extension of the Intended Completion Date	27.1 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 without the Contractor taking steps to accelerate the remaining work, which would cause the Contractor to incur additional cost. 27.2 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. If the Contractor has failed to give early warning of a delay or has failed to cooperate in dealing with a delay, the delay by this failure shall not be considered in assessing the new Intended Completion Date.
28 Delays Ordered by the Engineer	28.1 Engineer may instruct the Contractor to delay the start or progress of any activity within the Works.

29 Management Meetings	29.1 The Engineer may require the Contractor to attend a management meeting. The business of a management meeting shall be to review the plans for the Works. 29.2 The Engineer shall record the business of management meetings and provide copies of the record to those attending the meeting and to the Employer. The responsibility of the parties for actions to be taken shall be decided by the Engineer either at the management meeting or after the management meeting and stated in writing to all who attended the meeting.
30 Early Warning	30.1 The Contractor shall warn the Engineer at the earliest opportunity of specific likely future events or circumstances that may adversely affect the quality of the work, Increase the Contract Price, or delay the execution of the Works. The Engineer may require the Contractor to provide an estimate of the expected effect of the future event or circumstance on the Contract Price and Completion Date. The estimate shall be provided by the Contractor as soon as reasonably possible. 30.2 The Contractor shall cooperate with the Engineer In making and considering proposals for how the effect of such an event or circumstance can be avoided or reduced by anyone Involved In the work and In carrying out any resulting Instruction of the Engineer.
	Quality Control
31 .Identifying Defects	31.1 The Engineer shall check the Contractor's work and notify the Contractor of any Defects that are found. Such checking shall not affect the Contractor's responsibilities. The Engineer may instruct the Contractor to search for a Defect and to uncover and test any work that the Engineer considers may have a Defect.
32 . Tests	32.1 The Contractor shall provide all apparatus, assistance, documents and other Information, electricity, equipment, fuel, consumables, Instruments, labour, materials, and suitably qualified and experienced staff, as are necessary to carry out the specified tests efficiently. 32.2 If the Engineer Instructs the Contractor to carry out a test not specified In the Specification to check whether any work has a Defect and the test shows that it does, the Contractor shall pay for the test and any samples. If there is no Defect, the test shall be a Compensation Event.
33 . Identifying Defects and Correction of Defects	33.1 The Engineer shall check the Contractor's work and notify the Contractor of any Defects that are found. Such checking shall not affect the Contractor's responsibilities. The Engineer may instruct the Contractor to search for a Defect and to uncover and test any work that the Engineer considers may have a Defect. 33.2 The contractor shall permit the Employer's Technical auditor to check the contractor's work and notify the Engineer and Contractor of any defects that are found. Such a check shall not affect the Contractor's or the Engineer's responsibility as defined In the Contract Agreement.

	33.3 The Engineer shall give notice to the Contractor of any Defects before the end of the Defects Liability Period, which begins at Completion, and is **defined In the PCC.** The Defects Liability Period shall be extended for as long as Defects remain to be corrected. 33.4 Every time notice of a Defect is given, the Contractor shall correct the notified Defect within the length of time specified by the Engineer's notice.
34 . Uncorrected Defects	34.1 If the Contractor has not corrected a Defect within the time specified In the Engineer's notice, the Engineer shall assess the cost of having the Defect corrected, and the Contractor shall pay this amount.
	Cost Control
35 Contract Price	35.1 In the case of an item rate contract, the Bill of Quantities shall contain priced items for the Works to be performed by the Contractor. The Bill of Quantities is used to calculate the Contract Price. The Contractor will be paid for the quantity of the work accomplished at the rate in the Bill of Quantities for eachitem. 35.2 In the case of a lump sum contract, the Activity Schedule shall contain the priced activities for the Works to be performed by the Contractor. The Activity Schedule is used to monitor and control the performance of activities on which basis the Contractor will be paid. If payment for Materials on Site shall be made separately, the Contractor shall show delivery of Materials to the Site separately on the Activity Schedule.
36 Changes In the Contract Price	36.1 If the quantity of the work to be executed differs from the quantity in the Bill of Quantities for the particular item, it should be brought to the notice of the Engineer by the Contractor before the execution of work. After verification, the Engineer will approve or seek the approval of the Employer for such variations in quantities of the contract. 36.2 If requested by the Engineer, the Contractor shall provide the Engineer with a detailed cost breakdown of any rate in the Bill of Quantities.
37 Variations	37.1 The Engineer shall, having regard to the scope of the Works and the sanctioned estimated cost, have power to order, in writing, Variations within the scope of the Works he considers necessary or advisable during the progress of the Works. Such Variations shall form part of the Contract and the Contractor shall carry them out and include them in updated Programs produced by the Contractor. Oral orders of the Engineer for Variations, unless followed by written confirmation, shall not be taken into account.
38 Payments for Variations	38.1 If the work in the Variation corresponds with an item description in the Bill of Quantities and if, in the opinion of the Engineer, the quantity of work is above the limit stated in Sub Cl. 36.1, the rate in the bill of Quantities shall be used to calculate the value of the Variation in accordance with Sub Cl. 36.1. 38.2 If the work in the Variation doesn't correspond to any item description in the Bill of

	Quantities (i.e. Extra Item), the Contractor shall immediately bring it to the notice of Engineer before the execution of work and shall provide the Engineer, upon asking to do so by him in writing, with a quotation (with detailed breakup of unit rates) for carrying out the Variation. 38.3 The Engineer shall assess the quotation in accordance with the prevailing Schedule of Rates or DSR if the item is not available in SOR or prevailing market rate if the item is not available in both, the SOR and the DSR. The quotation shall be given within seven days of the request or within any longer period as stated by the Employer and before the Variation is ordered. 38.4 If the Contractor's quotation is unreasonable (or if the contractor fails to provide the Engineer with a quotation within a reasonable time specified by the Employer in accordance with Sub Cl. 38.3), the Employer may order the Variation and make a change to the Contract Price which shall be based on the prevailing Schedule of Rates or DSR or market rates in according in the sub clause 38.3. The contract price of such extra item shall be equal to the rate worked out as per this sub-clause if the overall cost of contract is above or equal to the estimated cost and shall be less by the same percentage to which the overall cost of the contract is less than estimated cost as the case may be. Decision of Employer shall be final in this regard.
39 Cash Flow Forecasts	39.1 When the Program, is updated, the Contractor shall provide the Engineer with an updated cash flow forecast.
40 Payment Certificates	40.1 The Contractor shall submit to the Engineer monthly statements of the estimated value of the work executed less the cumulative amount certified previously. 40.2 The Engineer shall check the Contractor’s monthly statement and certify the amount to be paid to the Contractor. 40.3 The value of work executed shall be determined by the Engineer. The value of work executed shall comprise: 40.4 In the case of a lump sum contract, the value of work executed shall comprise the value of completed activities in the Activity Schedule. 40.5 The value of work executed shall include the valuation of Variations and Compensation Events. 40.6 The Engineer may exclude any item certified in a previous certificate or reduce the proportion of any item previously certified in any certificate in the light of later information

41 Payments	41.1 Payments shall be adjusted for deductions for advance payments security deposit, other recoveries in terms of the Contract and taxes at source, as applicable under the law. The Engineer shall pay the Contractor the amounts he had certified within 30 days of the date of each certificate 41.2 The Employer may appoint another authority, as specified in the PCC (or any other competent person appointed by the Employer and notified to the contractor) to make payment certified by the Engineer. 41.3 Items of the Works for which no rate or price has been entered in shall not be paid for by the Employer and shall be deemed covered by other rates and prices In the Contract. 41.4 Payment for Operation and Maintenance period shall be paid in quarterly installment for every year of the rate quoted by bidder in price bid.
42 Compensation Events	42.1 The following shall be Compensation Events unless they are caused by the Contractor 42.1.1 The Engineer orders a delay or delays exceeding a total of 30days. 42.1.2 The effects on the Contractor of any of the Employer's Risks. 42.2 If a Compensation Event would prevent the Works being completed before the Intended Completion Date, the Intended Completion date shall be extended. The Employer shall decide whether and by how much the Intended Completion Date shall be extended.
43 Tax	43.1 The Engineer shall adjust the Contract Price if taxes, duties, and other levies are changed between the deadline for the submission of bids for the Contract and the date of the last Completion certificate. The adjustment shall be the change in the amount of tax payable by the Contractor, provided such changes are not already reflected In the Contract Price.
44 Currencies	44.1 All payments shall be made In Indian Rupees.
45 Price Adjustment	45.1 Not applicable
46 Security Deposit/ Retention and Release of Performance Security and Security Deposit/ Retention.	46.1 The Employer shall retain security deposit of 5% of the amount from each payment due to the Contractor until completion of the whole of the construction Work. No. security deposit/ retention shall be retained from the payments for Routine maintenance of works. 46.2 The total amount retained as Security Deposit is repaid to the contractor when the operation and maintenance has passed and the Engineer has certified that all defects notified by the Engineer to the contractor before the end of his period have been corrected. The retention amount may be released on submission of equivalent amount of FDR/TDR/BG valid till the completion of the O&M period

	46.3 The performance security equal to the five percent of the contract price of contract is repaid to the contractor when the period (Construction and operation and maintenance period) is over and the Engineer has certified that the contractor has satisfactorily carried out the Works. 46.4 If the contractor so desires then the Security Deposit can be converted into any interest bearing security of schedule commercial bank in the name of the Employer or National Saving Certificates duly pledged in favor of the Employer for Defect Liability Period including Operation and Maintenance.
47 Liquidated Damages	47.1 The Contractor shall pay liquidated damages to the Employer at the rate per week or part thereof stated in the PCC for the period that the Completion Date is later than the Intended Completion Date. Liquidated damages at the same rate shall be withheld if the Contractor fails to achieve the milestones prescribed in the PCC. However, in case the Contractor achieves the next milestone the amount of the liquidated damages already withheld shall be restored to the Contractor by adjustment in the next payment certificate. The total amount of liquidated damages shall not exceed the amount defined in the PCC. The Employer may deduct liquidated damages from payments due to the Contractor. Payment of liquidated damages shall not affect the Contractor's other liabilities. 47.2 If the Intended Completion Date is extended after liquidated damages have been paid, the Engineer shall correct any overpayment of liquidated damages by the Contractor by adjusting the next payment certificate.
48 Advance Payment	The Employer will make the interest bearing advance payment to the Contractor within 60 days of contract signing asfollows: 48.1 Mobilization advance payment up to a maximum of 10% of initial contract price shall be paid to the contractor after submission of an unconditional and irrevocable bank guarantee in a form given by the employer and from any scheduled commercial banks or nationalized banks acceptable to the Employer for an amount equal to the advance payment (to be drawn before the end of 20% of the contract period). 48.2 Materials advance shall be paid only for non-perishable items as 75% of the total value of materials brought at site. At any one time materials of not more than 20% value of total BOQ items will be brought at site .After the consumption of the materials brought at site , next lot of materials will be brought. 48.3 The Contractor is to use the advance payment only to pay for Nonperishable Materials and mobilization expenses required specifically for execution of the Contract. The Contractor shall demonstrate that advance payment has been used in this way by supplying copies of invoices or there documents to the Engineer. The recovery of mobilization advance shall start from bill after the work done exceeds 10% of the initial contract price or **three** months from the date of payment of advance which ever period concludes earlier and shall be made at the rate of 15% of the work done in each IPC

	(Interim payment certificate) The recovery of advance shall be completed when 90% of the work has been completed or prior to the expiry of original time for completion whichever is earlier. No account shall be taken of the advance payment or its repayment in assessing valuations of work done, Variations, price adjustments, Compensation Events, Bonuses, or Liquidated Damages.
49 Securities	49.1 The Performance Security equal to ten percent of the contract price and additional security for unbalanced bids shall be provided to the Employer no later than the date specified in the Letter of Acceptance and shall be issued in the form given in the PCC and by a scheduled commercial bank. The Performance Security shall be valid until a date 45 days from the date of expiry of Defect Liability Period including Operation and Maintenance and the additional security for unbalanced bids shall be valid until a date 45 days from the date of issue of the certificate of completion.
50 Cost of Repairs	50.1 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 his cost if the loss or damage arises from the Contractor's acts or omissions..
	Finishing the contract
51 Completion of Construction and Operation and Maintenance	51.1 The contractor shall request the Engineer to issue a certificate of completion of the construction of the works, and the Engineer will do so upon deciding that the construction works is completed and after successful completion of operation and maintenance period of one year certificate of operation and maintenance will be issued. In case the flag is damaged, then the contractor shall immediately replace the same with spare flag.
52 Taking Over	52.1 Effective from the Transfer Date or the termination date, whichever is later, the Contractor shall, transfer and assign to the Employer or its nominated agency, as the case may be, free and clear from any charges, liens and encumbrances created by the Contractor of all the Contractor's right, title and interest in and to the Works/ movable and immovable assets. The Contractor shall also deliver to the Employer or its nominated agency on transfer date or the termination date, whichever is later such project reports, manuals, plans, design drawings, reports, accounts operation and maintenance manual and other information as may reasonably be required by the Employer or its nominated agency to continue the operation of the Project either directly or by its nominated agency. The personnel of the Contractor may continue to be the employees of the Contractor subject to their written consent and the transfer of all the movable & immovable assets shall not in any manner affect their status as employees of the Contractor and they shall have no claim to any type of employment or compensation from the Employer or its nominated agency, which arises prior to such transfer. 52.2 On completion of the transfer by the Contractor to the Employer, the Employer shall issue an "Operation and Maintenance Agreement Completion Certificate" to the Contractor. The Operation and Maintenance Agreement Completion Certificate will have the effect of constituting evidence of transfer of all rights, titles and interests in the Project by the Contractor, and their vesting in the Employer.
53 Final	53.1 The contractor shall supply the Engineer with a detailed account of the total amount

Account	that the Contractor considers payable for construction works under the contract within 21 days of issue of certificate of completion of construction of works. The Engineer shall issue a defect liability including Operation and Maintenance certificate and certify any payment that is due to the correct and complete. If the account is not correct or complete, the Engineer shall issue within 42 days a schedule that states the scope of the corrections or additions that are necessary. If the account is still unsatisfactory after it has been resubmitted, the Engineer shall decide on the amount payable to the contractor and issue a payment certificate within 28 days of receiving the Contractor's revised account. The payment of final bill for construction of works will be made within 14 days thereafter. 53.2 In case the account is not received within 21 days of issue of Certificate of Completion as provided in clause 50. I above, the Engineer shall proceed to finalize the account and issue a payment certificate within 28 days. The payment of final bill for construction of works will be made within 14 days thereafter.
54 Operating and Maintenance Manuals	54.1 If "as built" Drawings and/or operating and maintenance manuals are required, the Contractor shall supply them by the dates stated in the PCC. 54.2 If the Contractor does not supply the Drawings and/or manuals by the dates stated in the PCC, or they do not receive the Engineer's approval, the Engineer shall withhold the amount stated in the PCC from payments due to the Contractor.
55 Termination	55.1 The Employer may terminate the Contract if the Contractor causes a fundamental breach of the Contract. 55.2 Fundamental breaches of Contract shall include, but shall not be limited to, the following: I. The Contractor stops work for 28 days when no stoppage of work is shown on the current Program and the stoppage has not been authorized by the Engineer; II. The Contractor is declared as bankrupt or goes into liquidation other than for approved reconstruction or amalgamation; III. The Engineer gives Notice that failure to correct a particular Defect is a fundamental breach of Contract and the Contractor fails to correct it within a reasonable period of time determined by the Engineer; IV. The Contractor does not maintain a Security, which is required; V. The Contractor has delayed the completion of the Works by the number of days for which the maximum amount of liquidated damages can be paid, as defined in clause 44.1; VI. Any other fundamental breaches as specified in the PCC. VII. If the Contractor fails to deploy machinery and equipment or personnel as specified in the PCC at the appropriate time. 55.3 Notwithstanding the above, the Employer may terminate the Contract for convenience

	55.4 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.
56 Payment upon Termination	56.1 If the Contract is terminated because of a fundamental breach of Contract by the Contractor, the Engineer shall issue a certificate for the value of the work done and Materials ordered less liquidated damages, if any less advance payments received up to the date of the issue of the certificate and less the percentage to apply to the value of the work not completed, as indicated in the PCC. If the total amount due to the Employer exceeds any payment due to the Contractor, the difference shall be recovered from the security deposit, and performance security. If any amount is still left un- recovered it will be a debt payable to the Employer. 56.2 If the Contract is terminated at the Employer's convenience, the Engineer shall issue a certificate 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.
57 Property.	57.1 All Materials on the Site, Plant, Equipment, Temporary Works, and Works shall be deemed to be the property of the Employer for use for completing balance construction work if the Contract is terminated because of the Contractor's default, till the Works is completed after which it will be transferred to the Contractor and credit, if any, given for its use.
58 Releases from Performance	58.1 If the Contract is frustrated by the outbreak of war or by any other event entirely outside the control of the Employer or the Contractor, the Engineer shall certify that the Contract has been frustrated. The Contractor shall make the Site safe and stop work as quickly as possible after receiving this certificate and shall be paid for all work carried out before receiving it and for any work carried out afterwards to which a commitment was made.

59 Labor Laws and Regulations	59.1 The Contractor shall comply with all relevant labor laws and regulations applicable to the Contractor's personnel. 59.2 The Contractor shall provide equal wages and benefits to men and women for work of equal value or type. 59.3 The Contractor shall not employ any child to perform work, including work that is economically exploitative, or is likely to be hazardous to, or to interfere with, the child's education, or to be harmful to the child's health or physical, mental, spiritual, moral, or social development. "Child" means a child below the statutory minimum age of 18 Years. 59.4 The Contractor shall not employ "forced and compulsory labor" in any form. "Forced or compulsory labor consists of all works or service, not voluntary performed that is extracted from an individual under threat or force or penalty. 59.5 The Contractor shall also comply the Labour law as given in Annexure 1
60 Environmental Laws and Regulations	60.1 The Contractor shall comply with all applicable national, provincial, and local environmental laws and regulations. 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 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. 60.2 The Contractor shall comply the Environment Management Plan as given in Annexure 2.
61 Force Majeure	61.1 The contractor shall not be liable for forfeiture of its Performance Security, liquidated damages, or termination for default if and to the extent that it's delay in performance or other failure to perform its obligations under the Contract is the result of an event of Force Majeure. 61.2 For purposes of this Clause, "Force Majeure" means an event or situation beyond the control of the Contractor that is not foreseeable, is unavoidable, and its origin is not due to negligence or lack of care on the part of the Contractor. Such events may include, but not be limited to, acts of the Employer in its sovereign capacity, wars or revolutions, fires, floods, epidemics, quarantine restrictions, and freight embargoes. 61.3 If a Force Majeure situation arises, the Contractor shall promptly notify the Employer in writing of such condition and the cause thereof. Unless otherwise

	directed by the Employer in writing, the Contractor shall continue to perform its obligations under the Contract as far as is reasonably practical, and shall seek all reasonable alternative means for performance not prevented by the Force Majeure event.
62 Role and Responsibility for Social Issue	62.1 The Contractor shall comply the Social issue given in Annexure 3.
63 Objective of PMC	63.1 The objective of this PMC is to assist the DSCL in implementation of the Project till the successful completion and handing over of all works to the DSCL and comprehensively supervise the works and activities carried out by the Bidder(s) as "Engineer's Representative" under the respective contract(s) in a manner that would ensure: 63.2 Total compliance of technical specifications and various other requirements contained in the respective contracts by the Bidder(s); 63.3 High standards of quality assurance system in the Consultancy as well as the works and activities of the Bidder(s); 63.4 Comprehensive and documented reporting to the DSCL of Consultant's own activities, progress of the Project(s) and compliances/ non-compliances by the Bidder(s); 63.5 Proper verification of measurements and bills submitted by the Bidder(s) so that payments made by the DSCL against these bills truly reflect the actual work done at site complying with the requirements of the respective contract(s);

Sec-VII: PARTICULAR CONDITIONS OF CONTRACT

A. General	
GCC 1.1 (q)	The Employer is Dehradun Smart City Limited, Dehradun, *Uttarakhand.*
GCC 1.1 (f)	Completion period for Rajpur Road Landscaping Project under "Smart City Mission" through e-Procurement is 03 (Three) months from the date of contract signing.
GCC 1.1 (r)	Engineer-in charge is AGM (Civil), Dehradun Smart City Limited.
GCC 1.1 (aa)	The Project Management Consultant is technical consultant appointed by the Employer shall proof-check all GFC drawings/design submitted by the successful bidder and approve the drawings for execution of works.
GCC 1.1 (cc)	The Site is located at, Dehradun, ABD area, Uttarakhand is defined In drawings.
GCC 1.1 (ff)	The intended Start Date shall be ***the date of the contract signing.***
GCC 1.1 (qq)	The Works consist Landscaping and other related projects in Rajpur Road, Dehradun
GCC 3.1	The language of the contract is *English.* The law that applies to the Contract is the laws of Republic of India.
GCC 5.1	The Engineer *may* delegate any of his duties and responsibilities.
GCC 14.1	Site Data are as per Scope of work and Technical Specifications etc.
GCC 21.1	The site will be physically handed over by the Employer to the Contractor on or before date of start as per contract agreement and both the employer as well as the Contractor will issue a joint signed letter mentioning the handing over and taken over of the site.
B. Time Control	
GCC 26.1	The Contractor shall submit for approval a Program for the Works within 15 days from the date of the Letter of Acceptance and the Program shall be a part of the contract.
GCC 26.4	The period between Program updates is 10 days. The amount to be withheld for late submission of an updated Program is INR 1, 00,000/-.
C. Quality Control	
GCC 33.3	The Defects Liability Period is: one year
D. Cost Control	
GCC 41.2	Employer may appoint another authority, will be Project Management Consultant
GCC 46.1	The proportion of payments retained (Retention Money) shall be 5% from each monthly bill subject to the maximum of 5% of final contract price.
GCC 47.1	The liquidated damages for the whole of the Works are *[0.5% of the final Contract Price]* per week. The maximum amount of liquidated damages for the whole of the Works is *10%* of the final Contract Price.

	or milestone 1 0.50% of the Contract Price per week For milestone 2 0.50 % of the contract price per week For milestone 3 0.50% of the contract price per week Milestone Physical target* of Period from the date of start of work works to be completed Milestone 1 20% 1/3rd of Intended completion period ** Milestone 2 50% 2/3rd of Intended completion period** Milestone 3 100% Full Intended completion period** *Physical progress shall be assessed as per the latest MPR duly verified by Engineer. ** Intended completion period shall be Six months from the Start Date.
GCC 48.1	An interest bearing advance of 10 % of contract value (if requested by the contractor) shall be given to the contractor on submission of an unconditional and irrevocable bank guarantee in a form given by the employer and from any scheduled commercial banks or nationalized banks acceptable to the Employer for an amount equal to the advance payment. The advance payment shall be adjusted from the monthly invoices uniformly. Interest rate shall be the selling rate of the State Bank of India
GCC 49.1	Within 21 (twenty one) days after receipt of the Letter of Acceptance/Award, the successful Bidder shall deliver to the Employer a Performance Security of Five (5%) of the Contract Price including of GST, valid up to the completion of the DLP period. The performance security shall be either in the form of an unconditional Bank Guarantee or fixed deposit Receipts (FDR)/ Time Deposit Receipts (TDR), in favor of Chief Executive Officer, Dehradun Smart City Limited Payable at Dehradun, Uttarakhand, from a Nationalized or Scheduled Commercial Bank. Failure of the successful Bidder to comply with the requirements of this Clause shall constitute sufficient grounds for cancellation of the award and forfeiture of the Earnest Money. He will also be debarred from participating in future bids under Dehradun Smart City Limited.
	Finishing the contract
GCC 54.1	The date by which “as built” drawings (and maintenance manuals) are required - within 56 days of issue of completion certificate
GCC 54.2	The amount to be withheld for failing to produce “as built” drawings by the date required in GCC 54.1 is 1 lakh (INR)
GCC 58.1	The percentage to apply to the value of the work not completed, representing the Employer’s additional cost for completing the Works, is 20%.

SECTION VIII
Bill of Quantities (BOQ)

Bill of Quantities (BOQ)

"The Price Bid BOQ is documented separately and can be downloaded from e-procurement portal http://uktenders.gov.in along with the RFP document. The price bid BOQ in EXCEL FORMAT which is available on http://uktenders.gov.in website should be completely filled and should be uploaded as a part of the bid without which the bid shall be treated as NON-RESPONSIVE." The bidder has to quote the prices ***EXCLUSIVE OF GST***.

SECTION IX - CONTRACT FORMS

This Section contains forms which, once completed, will form part of the Contract. The forms for Performance Security and Advance Payment Security, when required, shall only be completed by the successful Bidder after contract award.

Attachment: Contract Agreement

Contract Agreement

THIS AGREEMENT made the . . . . . Day of . . . . . ., ..., between . . . . . [name of the Employer]. . . . . (Hereinafter "the Employer"), of the one part, and . . . . . [name of the Contractor]. . . . .(hereinafter "the Contractor"), of the other part:

WHEREAS the Employer desires that the Works known as . . . . . [name of the Contract]. . . . .should be executed by the Contractor, and has accepted a Bid by the Contractor for the execution and completion of these Works and the remedying of any defects therein,

The Employer and the Contractor agree as follows:

1. In this Agreement words and expressions shall have the same meanings as are respectively assigned to them In the Contract documents referred to.
2. The following documents shall be deemed to form and be read and construed as part of this Agreement. This Agreement shall prevail over all other Contract documents.

(i) This Contract Agreement
(ii) The Letter of Award
(iii) The Contractor's Bid Including completed schedules and priced bill of quantities,
(iv) The addenda Nos. _____ (if any)
(v) The Particular Conditions
(vi) The General Conditions of Contract, Including appendix;
(vii) The Specification
(viii) The drawings(
(ix) Construction Program, Methodology, Quality Assurance Program and Environmental and Social Management Plan
(x) Any other document listed In the PCC as forming part of the Contract.

3. In consideration of the payments to be made by the Employer to the Contractor as specified in this Agreement, the Contractor hereby covenants with the Employer to execute the Works and to remedy defects therein In conformity In all respects with the provisions of the Contract.
4. The Employer hereby covenants to pay the Contractor In consideration of the execution and completion of the Works and the remedying of defects therein, 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.

IN WITNESS whereof the parties hereto have caused this Agreement to be executed In accordance with the laws of India. . . . .on the day, month and year specified above.

Signed by:	Signed by:
for and on behalf of the Employer	for and on behalf the Contractor
In the presence of:	In the presence of:
Witness, Name, Signature, Address, Date	Witness, Name, Signature, Address, Date

Performance Bank Guarantee

[Guarantor letterhead or SWIFT identifier code]

Performance Guarantee No……. ***[Insert guarantee reference number]***
Date……. ***[Insert date of issue of the guarantee]***

To:
Chief Executive Officer
Dehradun Smart City Limited
777, Saatvik Tower Kaulagarh Road,
Rajendra Nagar, Dehradun, Uttarakhand

In consideration of CEO, Dehradun Smart City limited (hereinafter as the "Employer", which expression shall, unless repugnant to the context or meaning thereof, include its successors, administrators and assigns) awarding to _____ ***(Name of the contractor)*** having its registered office at _____ (hereinafter referred as the "Contractor", which expression shall, unless repugnant to the context or meaning thereof, include its successors, administrators and assigns), vide letter no. _____ ***(LOA No.)*** dated _____ valued at INR _____ ***(Amount in figures and words)*** (herein after referred to as the "Contract value") the work for _____ ***(Name of the work)***. The Contractor _____ having agreed to furnish a Bank Guarantee amounting _____ ***(Amount in figures and words)*** to the Employer for Performance Security of the said Agreement.

We, the _____ ***(Name of the Bank)***, at a company constituted under the companies Act 1956 and deemed to be a banking company under the Banking Regulation Act 1949 having one of its branch office at _____ ***(Branch Office Address)*** and having its Registered Office at _____ ***(Registered Office Address)*** (herein after referred to as 'The Bank') at the request of the employer do hereby pay to the employer an amount not exceeding _____ ***(Performance Bank Guarantee Value in figures and words)*** against any loss or damage caused to or suffered or would be caused to or suffered by the Employer by reason of any breach by the said Contractor of any of the terms or conditions contained in the said Agreement.

We, _____ ***(Bank Name)*** hereby affirm that we are the Guarantor and responsible to Employer, on behalf of the Contractor, up to a total of _____ ***(Performance Bank Guarantee Value in figures and words)***, such sum being payable in the types of currencies in which the Contract Price is payable, and we undertake to pay you, upon your first written demand to "the bank" or any other branch of _____ ***(Name of Bank)*** without cavil or argument, any sum or sums

within the limits of _____***(Performance Bank Guarantee Value in figures and words)*** as aforesaid without needing to prove or to show grounds or reasons for demand for the sum specified therein however, such demand shall be made within the claim expiry date i.e. _____.

We, _____ ***(Name of Bank)*** undertake to pay to the employer any money so demanded notwithstanding any dispute or disputes raised by the Contractor in any suit or proceeding pending before any court or tribunal relating thereto, our liability under this present being absolute irrevocable and unequivocal. The payment so made by us under this bond shall be a valid discharge of our liability for payment there under and the Contractor shall have no claim against us for making such payment.

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

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

This guarantee will not be discharged due to the change in the constitution of the bank or the Contractor.

We, _____ ***(Name of Bank)*** lastly undertake not to revoke this guarantee during its currency except with the previous consent of employer in writing.

This guarantee shall be valid until _____ MONTHS (i.e.) 60 days following the Completion date of the Contract i.e. till _____including any warranty/Operation and Maintenance obligations, and any demand for payment under it must be received by us at this office on or before that date.

NOTWITHSTANDING ANYTHING CONTAINED HEREIN ABOVE:

(a) The Bank's liability under this guarantee shall not exceed the Guaranteed Amount i.e., _____ ***(Performance Bank Guarantee Value in figures and words)***

(b) This guarantee shall be valid up to the Expiry Date i.e._____ and

(c) The Bank is liable to pay the Guaranteed Amount or any part thereof under this Bank Guarantee only and only if a demand is made in writing on the Bank at any branch on or before the Claim Expiry Date i.e. _____, else all rights of the beneficiary under this Guarantee shall be forfeited and we shall be relieved and discharged from all liabilities there under.

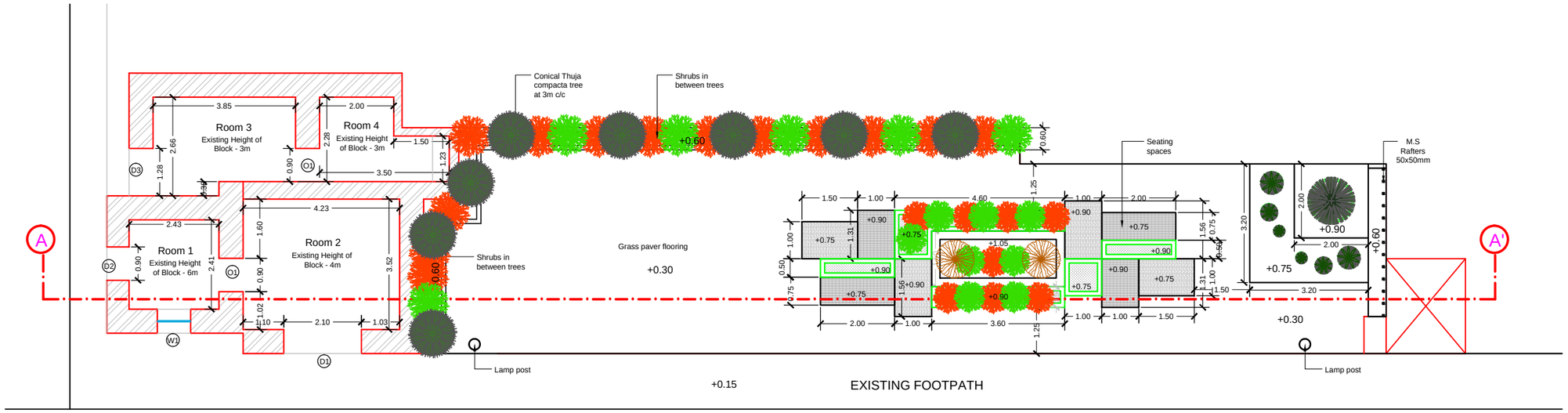
Signature and seal of the guarantor _____

Name of Bank -

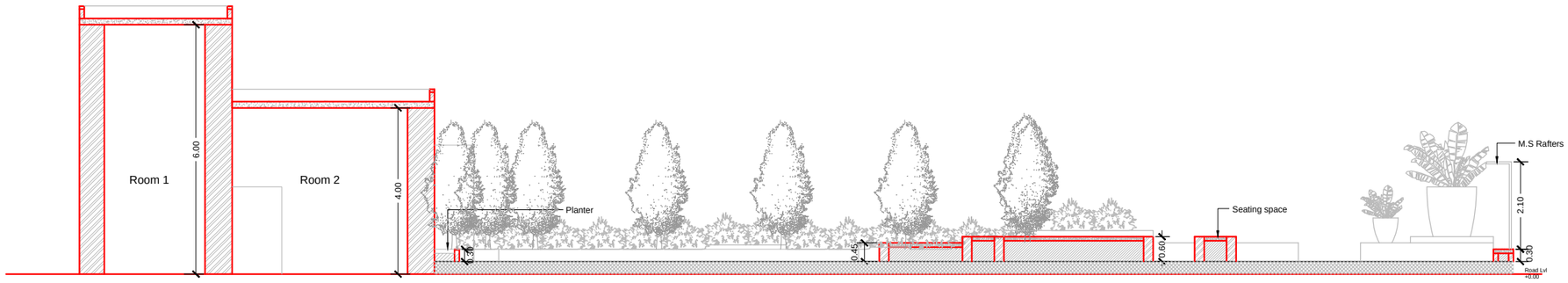
Address -

Date -

Note: All italicized text (including footnotes) is for use in preparing this form and shall be deleted from the final product.



LAYOUT OF RAJPUR ROAD- LANDSCAPE



SECTION AT A-A'

Notes

NOTES:-

- ALL DIMENSIONS ARE IN M
- LEVELS MENTIONED IN THE LAYOUT IS TAKEN FROM THE ROAD LEVEL

SCHEDULE OF OPENING

Type	Size	Description
D1	2.1x2.1 M	T.W DOOR
D2	0.9x2.1 M	T.W DOOR
D3	1.28x2.1 M	T.W DOOR
W1	0.9x1.2 M	T.W WINDOW - FULLY GLAZED
O1	0.9x2.1M	OPENING

LEGEND

Symbol	Description
	Plumeria Alba
	Thuja (Conical shape)
	Iresine herbstii
	Alpinia variegated
	Areca palm
	Livistona
	Wooden Finish Vitrified Tiles
	Plain Vitrified Tiles
	Grass

Rev	Date	Description	Remark
R2	Feb - 2020	For DPR	
R1	Dec - 2019	For DPR	
R0	Dec - 2019	For DPR	

Client :
DEHRADUN SMART CITY LIMITED

Project:
RAJPUR ROAD - LANDSCAPE
UNDER DEHRADUN SMART CITY PLAN

Drawing Title:
LAYOUT OF RAJPUR ROAD - LANDSCAPE

Project Management Consultant :

Corporate / Registered Office
F-33/3 Okhla Industrial Area
Phase-II, New Delhi-110020
INDIA+91-011-43500700 -800
+91-011-4350073

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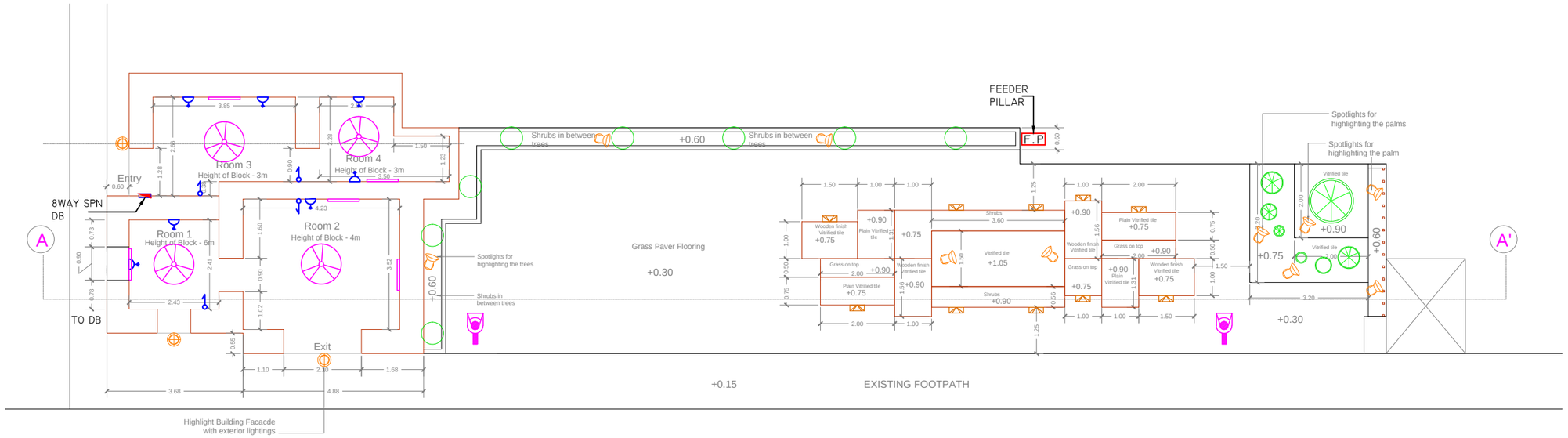
Place,New Delhi, Delhi 110001

Drawn by:	Ashwini B		Checked by:			
Engg Check:			Recommended:	Ajaya V		
Scale :	N.T.S	Status:	DPR	Rev:	R2	

Drawing No.
DSCL-PMC-AGSL-REPL-JLL-RP-LAY-TP-01



ELECTRICAL LAYOUT OF RAJPUR ROAD- LANDSCAPE

Notes

NOTES:-

- ALL DIMENSIONS ARE IN M

LEGEND

LEGEND:-

S. No.	SYMBOL	DESCRIPTION	POSITION
1.		6A ONE WAY SWITCH BOARD	1200
2.		1X6W SPOTLIGHT LED	
3.		1X3W RECESSED LIGHT	
4.		1X60W FACADE LIGHT	
5.		CEILING FAN	
6.		TUBELIGHT	
7.		45W LED LIGHT POLE (3.6M. HIGH)	
8.		6A SWITCH SOCKET OUTLET	350
9.		DISTRIBUTION BOARD	1500

Rev	Date	Description	Remark
R2	Feb - 2020	For DPR	
R1	Dec - 2019	For DPR	
R0	Dec - 2019	For DPR	

Client :

DEHRADUN SMART CITY LIMITED

Project:

RAJPUR ROAD - LANDSCAPE
UNDER DEHRADUN SMART CITY PLAN

Drawing Title:

ELECTRICAL LAYOUT OF RAJPUR ROAD - LANDSCAPE

Project Management Consultant :

almondz
REPL
JLL

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Drawn by:	Ashwini B		Checked by:			
Engg Chek:	Ravindra F		Recommended:	Ajaya V		
Scale :	N.T.S	Status:	DPR	Rev:	R2	

Drawing No.

DSCL-PMC-AGSL-REPL-JLL-RP-LAY-TP-01