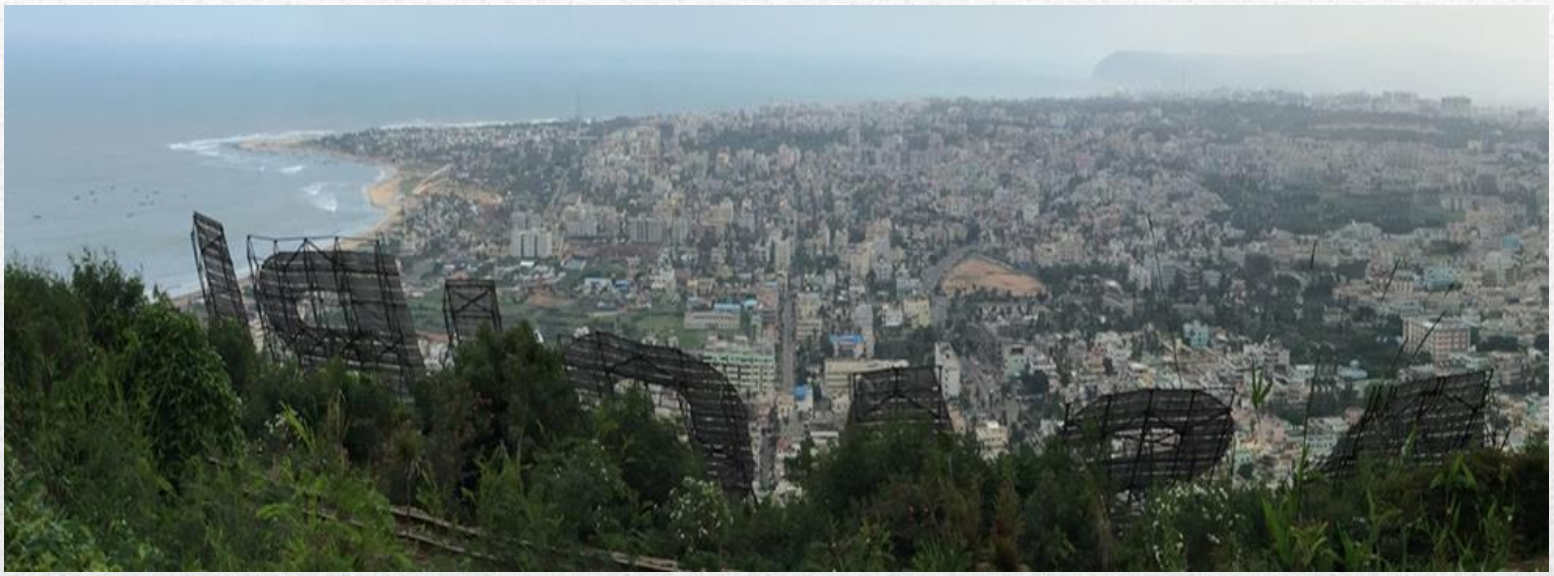
Greater Visakhapatnam Smart City Corporation Limited



BIDDING DOCUMENT

For the

Design, Construction, Operation and Maintenance of Mechanized Semi - Automatic Multi Level Car Parking Facility near Jagadamba Junction, Visakhapatnam

Under International Competitive Bidding

Part 1– Technical Bid –Volume 1

Issued on: 16 September 2017

Invitation for Bids No.: GVSCCL/PROJECTS/19 (MLCP)/2017-18
Employer: Greater Visakhapatnam Smart City Corporation Limited (GVSCCL), Visakhapatnam
Country: INDIA

Standard Procurement Document

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Section I - Instructions to Bidders

A. General		
1. Scope of Bid	1.1	In connection with the Specific Procurement Notice – Request for Bids (RFB), specified in the **Bid Data Sheet (BDS)**, the Employer, as **specified in the BDS**, issues this bidding document for the provision of Works as specified in Section VII, Works' Requirements. The name, identification, of this RFB are **specified in the BDS.**
	1.2	Throughout this bidding document: (a) the term "in writing" means communicated in written form (e.g. by mail, e-mail, fax, including if **specified in the BDS**, distributed or received through electronic-procurement system used by the Employer) with proof of receipt; (b) if the context so requires, "singular" means "plural' and vice versa; and (c) "Day" means calendar day, unless otherwise specified as a "Business Day." A Business Day is any day that is a working day of the Employer. It excludes the Employer official public holidays.
2. Source of Funds	2.1	Source of Fund is from Smart City Mission funds (Government of India and Government of Andhra Pradesh)
3. Fraud and Corruption	3.1	The Employer requires compliance with the Employer's Anti-Corruption Guidelines and its prevailing sanctions policies and procedures as set forth in the GOI's Sanctions Framework, as set forth in Section VI.
	3.2	In further pursuance of this policy, Bidders shall permit and shall cause their agents (where declared or not), subcontractors, sub-consultants, service providers, suppliers, and their personnel, to permit the Employer to inspect all accounts, records and other documents relating to any initial selection process, prequalification process, bid submission, proposal submission, and contract performance (in the case of award), and to have them audited by auditors appointed by the Employer.
4. Eligible Bidders	4.1	A Bidder may be a firm that is a private entity, or a state-owned enterprise or institution —subject to ITB 4.6—or any combination of them in the form of a joint venture (JV), under an existing agreement, or with the intent to enter into such an agreement supported by a letter of intent. In the case of a joint venture, all members shall be jointly and severally liable for the execution of the entire Contract in accordance with the Contract terms. The JV shall nominate a Representative who shall have the authority to conduct all business for and on behalf of any and all the members of the JV during the Bidding process and, in the event the JV is awarded the Contract, during contract execution. Unless **specified**

	in the BDS, there is no limit on the number of members in a JV.
	4.2 A Bidder shall not have a conflict of interest. All Bidders found to have a conflict of interest shall be disqualified. A Bidder may be considered to have a conflict of interest for the purpose of this Bidding process, if the Bidder: (a) directly or indirectly controls, is controlled by or is under common control with another Bidder; or (b) receives or has received any direct or indirect subsidy from another Bidder; or (c) has the same legal representative as another Bidder; or (d) has a relationship with another Bidder, directly or through common third parties, that puts it in a position to influence the Bid of another Bidder, or influence the decisions of the Employer regarding this Bidding process; or (e) or any of its affiliates participated as a consultant in the preparation of the design or technical specifications of the works that are the subject of the Bid; or (f) or any of its affiliates has been hired (or is proposed to be hired) by the Employer as Project Manager for the Contract implementation; (g) would be providing goods, works, or non-consulting services resulting from or directly related to consulting services for the preparation or implementation of the project **specified in the BDS** 2.1 that it provided or were provided by any affiliate that directly or indirectly controls, is controlled by, or is under common control with that firm; or (h) has a close business or family relationship with a professional staff of the Employer (or of the project implementing agency, or of a recipient of a part of the loan) who: (i) are directly or indirectly involved in the preparation of the bidding document or specifications of the contract, and/or the Bid evaluation process of such contract; or (ii) would be involved in the implementation or supervision of such contract unless the conflict stemming from such relationship has been resolved in a manner acceptable to the Employer throughout the procurement process and execution of the contract.
	4.3 A firm that is a Bidder (either individually or as a JV member) shall not participate in more than one Bid, except for permitted alternative Bids. This includes participation as a subcontractor in other Bids. Such participation shall result in the disqualification of all Bids in which the firm is involved. A firm that is not a Bidder or a JV member may participate as a subcontractor in more than one Bid.

	4.4	A Bidder may have the nationality of any country, subject to the restrictions pursuant to ITB 4.8. A Bidder shall be deemed to have the nationality of a country if the Bidder is constituted, incorporated or registered in and operates in conformity with the provisions of the laws of that country, as evidenced by its articles of incorporation (or equivalent documents of constitution or association) and its registration documents, as the case may be. This criterion also shall apply to the determination of the nationality of proposed subcontractors or sub-consultants for any part of the Contract including related Services.
	4.5	Bidders that are state-owned enterprises or institutions in the Employer's Country may be eligible to compete and be awarded a Contract(s) only if they can establish, in a manner acceptable to the Employer, that they (i) are legally and financially autonomous (ii) operate under commercial law, and (iii) are not under supervision of the Employer.
	4.6	A Bidder shall provide such documentary evidence of eligibility satisfactory to the Employer, as the Employer shall reasonably request.
	4.7	Firms of a country shall be excluded if, by an act of compliance with a decision of the United Nations Security Council taken under Chapter VII of the Charter of the United Nations, the Borrower's country prohibits any import of goods from that country or any payments to persons or entities in that country.
	4.8	In case a prequalification process has been conducted prior to the bidding process, this bidding is open only to prequalified Bidders.
5. Eligible Materials, Equipment and Services	5.1	The materials, equipment and services to be supplied under the Contract may have their origin in any country subject to the restrictions specified in Section V, Eligible Countries, and all expenditures under the Contract will not contravene such restrictions. At the Employer's request, Bidders may be required to provide evidence of the origin of materials, equipment and services.
B. Contents of Bidding Document		
6. Sections of Bidding Document	6.1	The bidding document consist of Parts 1, 2, and 3, which include all the sections specified below, and which should be read in conjunction with any Addenda issued in accordance with ITB 8. **PART 1 Bidding Procedures** • Section I - Instructions to Bidders (ITB) • Section II - Bid Data Sheet (BDS) • Section III - Evaluation and Qualification Criteria

	• Section IV - Bidding Forms • Section V - Eligible Countries • Section VI - Fraud and Corruption **PART 2 Works' Requirements** • Section VII – Works' Requirements **PART 3 Conditions of Contract and Contract Forms** • Section VIII - General Conditions of Contract • Section IX - Particular Conditions of Contract • Section X - Contract Forms
	6.2 Unless obtained directly from the Employer, the Employer is not responsible for the completeness of the bidding document, responses to requests for clarification, the minutes of the pre-Bid meeting (if any), or Addenda to the bidding document in accordance with ITB 8. In case of any contradiction, documents obtained directly from the Employer shall prevail.
	6.3 The Bidder is expected to examine all instructions, forms, terms, and specifications in the bidding document and to furnish with its Bid all information and documentation as is required by the bidding document.
7. Clarification of Bidding Document, Site Visit, Pre-Bid Meeting	7.1 A Bidder requiring any clarification of the bidding document shall contact the *Employer* in writing at the *Employer*'s address **specified in the BDS** or raise its inquiries during the pre-Bid meeting if provided for in accordance with ITB 7.4. The *Employer* will respond in writing to any request for clarification, provided that such request is received prior to the deadline for submission of Bids within a period **specified in the BDS**. The *Employer* may forward copies of its response to all Bidders who have acquired the bidding document in accordance with ITB 6.3, including a description of the inquiry but without identifying its source. If so **specified in the BDS**, the Employer shall also promptly publish its response at the web page **identified in the BDS**. Should the clarification result in changes to the essential elements of the bidding document, the Employer shall amend the bidding document following the procedure under ITB 8 and ITB 22.2.
	7.2 The Bidder is advised to visit and examine the Site of works and its surroundings and obtain for itself on its own 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.

	7.3	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.
	7.4	If so **specified in the BDS**, the Bidder's designated representative is invited to attend a pre-Bid meeting and/or a Site of works visit. The purpose of the meeting will be to clarify issues and to answer questions on any matter that may be raised at that stage.
	7.5	The Bidder is requested, to submit any questions in writing, to reach the *Employer* not later than one week before the meeting.
	7.6	Minutes of the pre-Bid meeting, if applicable, including the text of the questions asked by Bidders, without identifying the source, and the responses given, together with any responses prepared after the meeting, will be transmitted promptly to all Bidders who have acquired the bidding document in accordance with ITB 6.3. If so **specified in the BDS,** the Employer shall also promptly publish the Minutes of the pre-Bid meeting at the web page **identified in the BDS**. Any modification to the bidding document that may become necessary as a result of the pre-Bid meeting shall be made by the *Employer* exclusively through the issue of an addendum pursuant to ITB 8 and not through the minutes of the pre-Bid meeting. Nonattendance at the pre-Bid meeting will not be a cause for disqualification of a Bidder.
8. Amendment of Bidding Document	8.1	At any time prior to the deadline for submission of Bids, the *Employer* may amend the bidding document by issuing addenda.
	8.2	Any addendum issued shall be part of the bidding document and shall be communicated in writing to all who have obtained the bidding document from the Employer in accordance with ITB 6.3. The Employer shall also promptly publish the addendum on the Employer's web page in accordance with ITB 7.1.
	8.3	To give prospective Bidders reasonable time in which to take an addendum into account in preparing their Bids, the Employer may, at its discretion, extend the deadline for the submission of Bids, pursuant to ITB 22.2.
C. Preparation of Bids		
9. Cost of Bidding	9.1	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.
10. Language of Bid	10.1	The Bid, as well as all correspondence and documents relating to the Bid exchanged by the Bidder and the *Employer*, shall be written

	in the language **specified in the BDS**. Supporting documents and printed literature that are part of the Bid may be in another language provided they are accompanied by an accurate translation of the relevant passages in the language **specified in the BDS**, in which case, for purposes of interpretation of the Bid, such translation shall govern.
11. Documents Comprising the Bid	11.1 The Bid shall comprise two Parts, namely the Technical Part and the Financial Part. These two Parts shall be submitted simultaneously in two separate sealed envelopes (two-envelope Bidding process). One envelope shall contain only information relating to the Technical Part and the other, only information relating to the Financial Part. These two envelopes shall be enclosed in a separate sealed outer envelope marked "ORIGINAL BID". 11.2 The **Technical Part** shall contain the following: (a) **Letter of Bid – Technical Part,** prepared in accordance with ITB 12; (b) **Bid Security**, in accordance with ITB 19.1; (c) **Authorization**: written confirmation authorizing the signatory of the Bid to commit the Bidder, in accordance with ITB 20.3; (d) **Bidder's Eligibility:** documentary evidence in accordance with ITB 17.1 establishing the Bidder's eligibility to Bid; (e) **Qualifications:** documentary evidence in accordance with ITB 17.2 establishing the Bidder's qualifications to perform the Contract if its Bid is accepted; (f) **Conformity**: a technical proposal in accordance with ITB 16; (g) any other document **required in the BDS**. 11.3 The **Financial Part** shall contain the following: (a) **Letter of Bid – Financial Part:** prepared in accordance with ITB 12 and ITB 14; (b) any other document required **in the BDS.** 11.4 The Technical Part shall not include any information related to the Bid price. Where material financial information related to the Bid price is contained in the Technical Part the Bid shall be declared non-responsive. 11.5 In addition to the requirements under ITB 11.2, Bids submitted by a JV shall include a copy of the Joint Venture Agreement entered into by all members. Alternatively, a letter of intent to execute a Joint Venture Agreement in the event of a successful Bid shall be signed by all members and submitted with the Bid, together with a

	copy of the proposed Agreement. 11.6 The Bidder shall furnish in the Letter of Bid – Financial Part information on commissions and gratuities, if any, paid or to be paid to agents or any other party relating to this Bid.
12. Letters of Bid and Schedules	12.1 The Letter of Bid – Technical Part, Letter of Bid – Financial Part shall be prepared using the relevant forms furnished in Section IV, Bidding Forms. The forms must be completed without any alterations to the text, and no substitutes shall be accepted except as provided under ITB 20.3. All blank spaces shall be filled in with the information requested.
13. Alternative Bids	13.1 Unless otherwise **specified in the BDS**, alternative Bids shall not be considered.
	13.2 When alternative times for completion are explicitly invited, a statement to that effect will be **included in the BDS**, and the method of evaluating different alternative times for completion will be described in Section III, Evaluation and Qualification Criteria.
	13.3 Except as provided under ITB 13.4 below, Bidders wishing to offer technical alternatives to the requirements of the bidding document must first price the Employer's design as described in the bidding document and shall further provide all information necessary for a complete evaluation of the alternative by the Employer, including drawings, design calculations, technical specifications, breakdown of prices, and proposed construction methodology and other relevant details. Only the technical alternatives, if any, of the Bidder with the Most Advantageous Bid conforming to the basic technical requirements shall be considered by the Employer.
	13.4 When **specified in the BDS**, Bidders are permitted to submit alternative technical solutions for specified parts of the Works. Such parts will be **identified in the BDS** and described in Section *VII, Works'* Requirements. The method for their evaluation will be stipulated in Section *III,* Evaluation and Qualification Criteria.
14. Bid Prices and Discounts	14.1 The prices and discounts quoted by the Bidder in the Letter of Bid – Financial Part and in the Priced Activity Schedule or Bill of Quantities shall conform to the requirements specified below.
	14.2 The Bidder shall submit a Bid for the whole of the Works described in ITB 1.1 by filling in prices for all items of the Works, as identified in Section IV, Bidding Forms. In case of admeasurement contracts, the Bidder shall fill in rates and prices for all items of the Works described in the Bill of Quantities. Items against which no rate or price is entered by the Bidder will not be paid for by the Employer when executed and shall be deemed covered by the rates for other items and prices in the Bill of Quantities.
	14.3 The price to be quoted in the Letter of Bid – Financial Part, in accordance with ITB 12.1, shall be the total price of the Bid, excluding any discounts offered.

	14.4 The Bidder shall quote any discounts and indicate the methodology for their application in the Letter of Bid - Financial Part, in accordance with ITB 12.1.
	14.5 Unless otherwise **provided in the BDS,** and the Conditions of Contract, th**e** prices quoted by the Bidder shall be fixed. If the prices quoted by the Bidder are subject to adjustment during the performance of the Contract in accordance with the provisions of the Conditions of Contract, the Bidder shall furnish the indices and weightings for the price adjustment formulae in the Schedule of Adjustment Data in Section IV- Bidding Forms and the Employer may require the Bidder to justify its proposed indices and weightings. 14.6 If so specified in ITB 1.1, Bids are invited for individual contracts. Bidders wishing to offer discounts for the award of more than one Contract shall specify in their Bid the price reductions applicable to each package, or alternatively, to individual Contracts within the package. Discounts shall be submitted in accordance with ITB 14.4, provided the Bids for all contracts are opened at the same time.
	14.7 All duties, taxes, and other levies payable by the Contractor under the Contract, or for any other cause, as of the date 28 days prior to the deadline for submission of Bids, shall be included in the rates and prices and the total Bid price submitted by the Bidder.
15. Currencies of Bid and Payment	15.1 The currency(ies) of the Bid and the currency(ies) of payments shall be the same and shall be as **specified in the BDS.**
	15.2 Bidders may be required by the Employer to justify, to the Employer's satisfaction, their local and foreign currency requirements, and to substantiate that the amounts included in the unit rates and prices and shown in the Schedule of Adjustment Data are reasonable, in which case a detailed breakdown of the foreign currency requirements shall be provided by Bidders.
16. Documents Comprising the Technical Proposal	16.1 The Bidder shall furnish a technical proposal in the Technical Part of the Bid including a statement of work methods, equipment, personnel, schedule and any other information as stipulated in Section *IV,* Bidding Forms, in sufficient detail to demonstrate the adequacy of the Bidders' proposal to meet the work's requirements and the completion time.
17. Documents Establishing the Eligibility and Qualifications of the Bidder	17.1 To establish Bidder's eligibility in accordance with ITB 4, Bidders shall complete the Letter of Bid, – Technical Part, included in Section IV, Bidding Forms. 17.2 In accordance with Section III, Evaluation and Qualification Criteria, to establish its qualifications to perform the Contract, the Bidder shall provide the information requested in the corresponding information sheets included in Section *IV,* Bidding Forms.
	17.3 If a margin of preference applies as specified in accordance with ITB 38.1, domestic Bidders, individually or in joint ventures,

		applying for eligibility for domestic preference shall supply all information required to satisfy the criteria for eligibility specified in accordance with ITB 38.1.
18. Period of Validity of Bids	18.1	Bids shall remain valid for the Bid Validity period **specified in the BDS**. The Bid Validity period starts from the date fixed for the Bid submission deadline (as prescribed by the Employer in accordance with ITB 22.1). A Bid valid for a shorter period shall be rejected by the Employer as nonresponsive.
	18.2	In exceptional circumstances, prior to the expiration of the Bid validity period, the Employer may request Bidders to extend the period of validity of their Bids. The request and the responses shall be made in writing. If a Bid Security is requested in accordance with ITB 19, it shall also be extended for twenty-eight (28) days beyond the deadline of the extended validity period. A Bidder may refuse the request without forfeiting its Bid Security. A Bidder granting the request shall not be required or permitted to modify its Bid, except as provided in ITB 18.3.
	18.3	If the award is delayed by a period exceeding fifty-six (56) days beyond the expiry of the initial Bid validity period, the Contract price shall be determined as follows: (a) in the case of fixed price contracts, the Contract price shall be the Bid price adjusted by the factor **specified in the BDS;**
		(b) in the case of adjustable price contracts, no adjustment shall be made; or
		(c) in any case, Bid evaluation shall be based on the Bid price without taking into consideration the applicable correction from those indicated above.
19. Bid Security	19.1	The Bidder shall furnish as part of its Technical Part of its Bid, either a Bid-Securing Declaration or a Bid Security as **specified in the BDS**, in original form and, in the case of a Bid security, in the amount and currency **specified in the BDS**.
	19.2	A Bid-Securing Declaration shall use the form included in Section IV, Bidding Forms.
	19.3	*If a Bid Security is specified pursuant to ITB 19.1*, the Bid Security shall be a demand guarantee, and in any of the following forms at the Bidder's option: (a) an irrevocable unconditional bank guarantee, (b) an irrevocable letter of credit, or (c) Transfer through NEFT/ RTGS/ Over the counter payment or any other format as prescribed in the website of the Employer (d) another security **specified in the BDS,**

	19.4 If a Bid Security or Bid-Securing Declaration is specified pursuant to ITB 19.1, any Bid not accompanied by a substantially responsive Bid Security or Bid-Securing Declaration shall be rejected by the Employer as non-responsive.
	19.5 If a Bid Security is specified pursuant to ITB 19.1, the Bid Security of unsuccessful Bidders shall be returned as promptly as possible upon the successful Bidder's signing the Contract and furnishing the Performance Security.
	19.6 The Bid Security of the successful Bidder shall be returned as promptly as possible once the successful Bidder has signed the Contract and furnished the required Performance Security and.
	19.7 The Bid Security may be forfeited or the Bid-Securing Declaration executed: (a) if a Bidder withdraws its Bid during the period of Bid validity specified by the Bidder on the Letter of Bid – Technical Part and repeated in the Letter of Bid – Financial Part or any extension thereto provided by the Bidder; or (b) if the successful Bidder fails to: (i) sign the Contract in accordance with ITB 49; or (ii) furnish a Performance Security.
	19.8 The Bid Security or the Bid-Securing Declaration of a *JV* shall be in the name of the *JV* that submits the Bid. If the *JV* has not been constituted into a legally enforceable *JV*, at the time of Bidding, the Bid Security or the Bid-Securing Declaration shall be in the names of all future members as named in the letter of intent mentioned in ITB 4.1 and ITB 11.5.
	19.9 If a Bid Security is **not required in the BDS**, pursuant to ITB 19.1, and: (a) if a Bidder withdraws its Bid during the period of Bid validity specified by the Bidder in the Letters of Bid; or (b) if the successful Bidder fails to: sign the Contract in accordance with ITB 49; or furnish a Performance Security; the Employer may, if provided for **in the BDS**, declare the Bidder ineligible to be awarded a contract by the Employer for a period of time as **stated in the BDS**.
20. Format and Signing of Bid	20.1 The Bidder shall prepare the Bid, in accordance with this Instruction, ITB 11 and ITB 21. 20.2 Bidders shall mark as "CONFIDENTIAL" information in their Bids which is confidential to their business. This may include proprietary information, trade secrets or commercial or financially sensitive information.

	20.3 The original and all copies of 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. All pages of the Bid where entries or amendments have been made shall be signed or initialed by the person signing the Bid.
	20.4 In case the Bidder is a JV, the Bid shall be signed by an authorized representative of the JV on behalf of the JV, and so as to be legally binding on all the members as evidenced by a power of attorney signed by their legally authorized representatives. 20.5 Any interlineations, erasures, or overwriting shall be valid only if they are signed or initialed by the person signing the Bid.
D. Submission of Bids	
21. Sealing and Marking of Bids	21.1 The Bidder shall submit the bids through e-portal. All the documents required for Technical qualification shall be submitted as per ITB and formats as per Section IV of the RFP documents. Bidder shall submit all the required documents and submit as per the standard procurement procedures of the E-portal *http:www.apeprocurement.gov.in.* 21.2 Financial Part shall be uploaded in the given format in web portal. 21.3 All the submission will be as mentioned in BDS.
	21.4 In addition, the Bidder shall submit hard copy of the Bid in the number **if specified in the BDS**. All the required documents shall be uploaded in the e-portal and Employer shall not have any liability towards the failure in uploading of the documents by the Bidder. 21.5 The envelopes marked "ORIGINAL BID" and "BID COPIES" shall be enclosed in a separate sealed outer envelope for submission to the Employer **if required as BDS.**
	21.6 All inner and outer envelopes, shall:
	(a) bear the name and address of the Bidder; (b) be addressed to the Employer in accordance with ITB 22.1; (c) bear the specific identification of this Bidding process indicated in ITB 1.1; and (d) bear a warning not to open before the time and date for Bid opening.
	21.7 If all envelopes are not sealed and marked as required, the Employer will assume no responsibility for the misplacement or

		premature opening of the Bid.
22. Deadline for Submission of Bids	22.1	Bids must be received by the *Employer* at the address and no later than the date and time **specified in the BDS**. **When so specified in the BDS**, Bidders shall have the option of submitting their Bids electronically. Bidders submitting Bids electronically shall follow the electronic Bid submission procedures **specified in the BDS.**
	22.2	The *Employer* may, at its discretion, extend the deadline for the submission of Bids by amending the bidding document in accordance with ITB 8, in which case all rights and obligations of the *Employer* and Bidders previously subject to the deadline shall thereafter be subject to the deadline as extended.
23. Late Bids	23.1	The *Employer* shall not consider any Bid that arrives after the deadline for submission of Bids, in accordance with ITB 22. Any Bid received by the *Employer* after the deadline for submission of Bids shall be declared late, rejected, and returned unopened to the Bidder.
24. Withdrawal, Substitution, and Modification of Bids	24.1	A Bidder may withdraw, substitute, or modify its Bid after it has been submitted by sending a written notice, duly signed by an authorized representative, and shall include a copy of the authorization in accordance with ITB 20.3, (except that withdrawal notices do not require copies). The corresponding substitution or modification of the Bid must accompany the respective written notice. All notices must be: (a) prepared and submitted in accordance with ITB 20 and ITB 21 (except that withdrawal notices do not require copies), and in addition, the respective envelopes shall be clearly marked "WITHDRAWAL," "SUBSTITUTION," "MODIFICATION;" and (b) received by the Employer prior to the deadline prescribed for submission of Bids, in accordance with ITB 22.
	24.2	Bids requested to be withdrawn in accordance with ITB 24.1 shall be returned unopened to the Bidders.
	24.3	No Bid may be withdrawn, substituted, or modified in the interval between the deadline for submission of Bids and the expiration of the period of Bid validity specified by the Bidder on the Letter of Bid or any extension thereof.
	E.	**Public Opening of Technical Parts of Bids**
25. Public Opening of Technical Parts of Bids	25.1	Except in the cases specified in ITB 23 and ITB 24.2, the Employer shall publicly open and read out all Bids received by the deadline, at the date, time and place **specified in the BDS**, in the presence of Bidders` designated representatives and anyone who chooses to attend. All Bidders, or their representatives and any interested party may attend a public opening. Any specific electronic Bid opening procedures required if electronic bidding is permitted in accordance

	with ITB 22.1, shall be **as specified in the BDS**.
	25.2 First, the written notice of withdrawal in the envelopes marked "WITHDRAWAL" shall be opened and read out and the envelope with the corresponding Bid shall not be opened, but returned to the Bidder. No Bid withdrawal shall be permitted unless the corresponding withdrawal notice contains a valid authorization to request the withdrawal and is read out at Bid opening. 25.3 Next, envelopes marked "Substitution" shall be opened and read out and exchanged with the corresponding Bid being substituted, and the substituted Bid shall not be opened, but returned to the Bidder. No Bid substitution shall be permitted unless the corresponding substitution notice contains a valid authorization to request the substitution and is read out at Bid opening.
	25.4 Next, envelopes marked "MODIFICATION" shall be opened and read out with the corresponding Bid. No Bid modification shall be permitted unless the corresponding modification notice contains a valid authorization to request the modification and is read out at Bid opening.
	25.5 Next, all other envelopes marked "TECHNICAL PART" shall be opened one at a time. On opening the envelopes marked "TECHNICAL PART" the Employer shall read out: the name of the Bidder, the presence or the absence of a Bid Security, or Bid-Securing Declaration, if required, and whether there is a modification; and Alternative Bid - Technical Part; and any other details as the Employer may consider appropriate. 25.6 Only Technical Parts of Bids and Alternative Bid - Technical Parts that are read out at Bid opening shall be considered further for evaluation. The Letter of Bid- Technical Part: FINANCIAL PROPOSAL" are to be initialed by representatives of the Employer attending Bid opening in the manner **specified in the BDS**.
	25.7 At the Bid opening the Employer shall neither discuss the merits of any Bid nor reject any Bid (except for late Bids, in accordance with ITB 23.1).
	25.8 The Employer shall prepare a record of the Technical Parts of Bid opening that shall include, as a minimum: (a) the name of the Bidder and whether there is a withdrawal, substitution, or modification; (b) the receipt of envelopes that there are no "FINANCIAL PART" submitted in the Hard Copy; (c) the presence or absence of a Bid Security or Bid-Securing Declaration, if one was required; and (d) if applicable, any Alternative Bid – Technical Part.

	25.9 The Bidders' representatives who are present shall be requested to sign the record. The omission of a Bidder's signature on the record shall not invalidate the contents and effect of the record. A copy of the record shall be distributed to all Bidders.
F. Evaluation of Bids – General Provisions	
26. Confidentiality	26.1 Information relating to the evaluation of Bids and recommendation of contract award, shall not be disclosed to Bidders or any other persons not officially concerned with the Bidding process until information on Intention to Award the Contract is transmitted to all Bidders in accordance with ITB 44.
	26.2 Any effort by a Bidder to influence the Employer in the evaluation of the Bids or Contract award decisions may result in the rejection of its Bid.
	26.3 Notwithstanding ITB 26.2, from the time of Bid opening to the time of Contract award, if a Bidder wishes to contact the *Employer* on any matter related to the Bidding process, it shall do so in writing.
27. Clarification of Bids	27.1 To assist in the examination, evaluation, and comparison of the Bids, and qualification of the Bidders, the Employer may, at its discretion, ask any Bidder for a clarification of its Bid given a reasonable time for a response. 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, including any voluntary increase or decrease in the prices or substance of the Bid shall be sought, offered, or permitted, except to confirm the correction of arithmetic errors discovered by the Employer in the evaluation of the Bids, in accordance with ITB 36.
	27.2 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.
28. Deviations, Reservations, and Omissions	28.1 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 withholding from complete acceptance of the requirements specified in the bidding document; and (c) "Omission" is the failure to submit part or all of the information or documentation required in the bidding document.
29. Nonmaterial Nonconformities	29.1 Provided that a Bid is substantially responsive, the Employer may waive any non-conformities in the Bid. 29.2 Provided that a Bid is substantially responsive, the Employer may

	request that the Bidder submit the necessary information or documentation, within a reasonable period of time, to rectify nonmaterial nonconformities in the Bid related to documentation requirements. Requesting information or documentation on such nonconformities shall not be related to any aspect of the price of the Bid. Failure of the Bidder to comply with the request may result in the rejection of its Bid.
	29.3 Provided that a Bid is substantially responsive pursuant to ITB 31, the *Employer* shall rectify quantifiable nonmaterial nonconformities related to the Bid price. To this effect, the Bid price may be adjusted, for comparison purposes only, to reflect the price of a missing or non-conforming item or component in the manner **specified in the BDS**.
G. Evaluation of Technical Parts of Bids	
30. Evaluation of Technical Parts	30.1 In evaluating the Technical Parts of each Bid, the Employer shall use the criteria and methodologies listed in this ITB and Section III, Evaluation and Qualification Criteria. No other evaluation criteria or methodologies shall be permitted.
31. Determination of Responsiveness	31.1 The *Employer*'s determination of a Bid's responsiveness is to be based on the contents of the Bid itself, as defined in ITB 11. 31.2 A substantially responsive Bid is one that meets the requirements of the bidding document without material deviation, reservation, or omission. A material deviation, reservation, or omission is one that: (a) if accepted, would: (i) affect in any substantial way the scope, quality, or performance of the Works specified in the Contract; or (ii) limit in any substantial way, inconsistent with the bidding document, the Employer's rights or the Bidder's obligations under the proposed Contract; or (b) if rectified, would unfairly affect the competitive position of other Bidders presenting substantially responsive Bids.
	31.3 The Employer shall examine the technical aspects of the Bid submitted in accordance with ITB 16, in particular, to confirm that all requirements of Section VII, Works' Requirements have been met without any material deviation, reservation or omission.
	31.4 If a Bid is not substantially responsive to the requirements of the bidding document, it shall be rejected by the *Employer* and may not subsequently be made responsive by correction of the material deviation, reservation, or omission.
32. Qualification of the Bidder	32.1 The *Employer* shall determine to its satisfaction whether the eligible Bidders that have submitted substantially responsive Bid - Technical Parts meet the qualifying criteria specified in Section III,

	Evaluation and Qualification Criteria.
	32.2 The determination shall be based upon an examination of the documentary evidence of the Bidder's qualifications submitted by the Bidder, pursuant to ITB 17. The determination shall not take into consideration the qualifications of other firms such as the Bidder's subsidiaries, parent entities, affiliates, subcontractors (other than Specialized Subcontractors if permitted in the bidding document), or any other firm different from the Bidder.
	32.3 If a Bidder does not meet the qualifying criteria specified in Section III, Evaluation and Qualification Criteria, its Bid shall be rejected by the Employer and may not subsequently be made responsive by correction of the material deviation, reservation, or omission.
	32.4 Only Bids that are both substantially responsive to the bidding document, and meet all Qualification Criteria shall have their "FINANCIAL PART" submitted in e-portal opened at the second public opening.
33. Subcontractors	33.1 Unless otherwise stated **in the BDS**, the Employer does not intend to execute any specific elements of the Works by subcontractors selected in advance by the Employer. 33.2 The subcontractor's qualifications shall not be used by the Bidder to qualify for the Works unless their specialised parts of the Works were previously designated by the Employer **in the BDS** as can be met by subcontractors referred to hereafter as 'Specialized Subcontractors', in which case, the qualifications of the Specialized Subcontractors proposed by the Bidder may be added to the qualifications. 33.3 Bidders may propose subcontracting up to the percentage of total value of contracts or the volume of works as **specified in the BDS.** Subcontractors proposed by the Bidder shall be fully qualified for their parts of the Works.
	H. Public Opening of Financial Parts of Bids
34. Public Opening of Financial Parts	34.1 Following the completion of the evaluation of the Technical Parts of the Bids, and the Bank has issued its no objection (if applicable), the Employer may notify in writing or upload the same in e-portal those Bidders whose Bids were considered non-responsive to the bidding document or failed to meet the Qualification Criteria, advising them of the following information:
	(a) the grounds on which their Technical Part of Bid failed to meet the requirements of the bidding document; (b) their "FINANCIAL PART" uploaded in web portal will be not be opened; and

	34.2 The Employer shall, simultaneously, notify in writing or upload in e-portal those Bidders whose Technical Part have been evaluated as substantially responsive to the bidding document and met all Qualifying Criteria, advising them of the following information: (a) their Bid has been evaluated as substantially responsive to the bidding document and met the Qualification Criteria; (b) their "FINANCIAL PART" uploaded in e-portal will be opened at the public opening of the Financial Parts; and (c) notify them of the date, time and location of the second public opening of the "FINANCIAL PART" **as specified in the BDS.**
	34.3 The opening date should allow Bidders sufficient time to make arrangements for attending the opening. The Financial Part of the Bid shall be opened publicly in the presence of Bidders' designated representatives and anyone who chooses to attend.
	34.4 At this public opening the Financial Parts will be opened by the Employer in the presence of Bidders, or their designated representatives and anyone else who chooses to attend. Bidders who met the Qualification Criteria and whose bids were evaluated as substantially responsive will have their "FINANCIAL PART" opened at the second public opening. The Employer shall read out the names of each Bidder, and the total Bid prices, per contract if applicable, and any other details as the Employer may consider appropriate.
	34.5 The Employer shall neither discuss the merits of any Bid nor reject " FINANCIAL PART".
	34.6 The Employer shall prepare a record of the Financial Part of the Bid opening that shall include, as a minimum: (a) the name of the Bidder whose Financial Part was opened; (b) the Bid price, per contract if applicable, including any discounts; and
	34.7 The Bidders whose "FINANCIAL PART" have been opened or their representatives who are present shall be requested to sign the record. The omission of a Bidder's signature on the record shall not invalidate the contents and effect of the record. A copy of the record shall be distributed to all Bidders.
I. Evaluation of Financial Parts of Bids	
35. Evaluation of	35.1 To evaluate the Financial Part, the Employer shall consider the

Financial Parts	following:
	(a) the Bid price, excluding Provisional Sums and the provision, if any, for contingencies in the Summary Bill of Quantities[1] for admeasurement contracts, but including Day work[2] items, where priced competitively;
	(b) price adjustment for correction of arithmetic errors in accordance with ITB 36.1;
	(c) price adjustment due to discounts offered in accordance with ITB 14.4;
	(d) converting the amount resulting from applying (a) to (c) above, if relevant, to a single currency in accordance with ITB 37; (e) price adjustment due to quantifiable nonmaterial nonconformities in accordance with ITB 29.3; and
	(f) the additional evaluation factors are specified in Section III, Evaluation and Qualification Criteria.
	35.2 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.
	35.3 If this bidding document allows Bidders to quote separate prices for different contracts, the methodology to determine the lowest evaluated cost of the contract combinations, including any discounts offered in the Letter of Bid – Financial Part, is specified in Section III, Evaluation and Qualification Criteria
36. Correction of Arithmetical Errors	36.1 In evaluating the Financial Part of each Bid, the Employer shall correct arithmetical errors on the following basis:
	(a) only for admeasurement contracts, if there is a discrepancy between the unit price and the total price that is obtained by multiplying the unit price and quantity, the unit price shall prevail and the total price shall be corrected, unless in the opinion of the Employer there is an obvious misplacement of the decimal point in the unit price, in which case the total price as quoted shall govern and the unit price shall be corrected; (b) if there is an error in a total corresponding to the addition or subtraction of subtotals, the subtotals shall prevail and the

[1] In lump-sum contracts, delete "Bill of Quantities" and replace with "Activity Schedule."

[2] Daywork is work carried out following instructions of the Project Manager and paid for on the basis of time spent by workers, and the use of materials and the Contractor's equipment, at the rates quoted in the Bid. For Daywork to be priced competitively for Bid evaluation purposes, the Employer must list tentative quantities for individual items to be costed against Daywork (e.g., a specific number of tractor driver staff-days, or a specific tonnage of Portland cement), to be multiplied by the Bidders' quoted rates and included in the total Bid price.

	total shall be corrected; and (c) if there is a discrepancy between words and figures, the amount in words shall prevail, unless the amount expressed in words is related to an arithmetic error, in which case the amount in figures shall prevail subject to (a) and (b) above.
	36.2 Bidders shall be requested to accept correction of arithmetical errors. Failure to accept the correction in accordance with ITB 36.1, shall result in the rejection of the Bid.
37. Conversion to Single Currency	37.1 For evaluation and comparison purposes, the currency(ies) of the Bids shall be converted in a single currency as **specified in the BDS.**
38. Margin of Preference	38.1 Unless otherwise **specified in the BDS,** a margin of preference for domestic Bidders[3] shall not apply.
39. Comparison of Financial Parts	39.1 The Employer shall compare the evaluated costs of all responsive and qualified Bids to determine the Bid that has the lowest evaluated cost.
40. Abnormally Low Bids	40.1 An Abnormally Low Bid is one where the Bid price, in combination with other constituent elements of the Bid, appears unreasonably low to the extent that the Bid price raises material concerns as to the capability of the Bidder to perform the Contract for the offered Bid price.
	40.2 In the event of identification of a potentially Abnormally Low Bid, the Employer shall seek written clarifications from the Bidder, including detailed price analyses of its Bid price in correlation to the subject matter of the contract, scope, proposed methodology, schedule, allocation of risks and responsibilities and any other requirements of the bidding document. 40.3 After evaluation of the price analyses, in the event that the Employer determines that the Bidder has failed to demonstrate its capability to deliver the contract for the offered tender price, the Employer shall reject the Bid.
41. Unbalanced or Front Loaded Bids	41.1 If the Bid for an admeasurement contract, which results in the lowest evaluated cost, in the Employer's opinion, seriously unbalanced or front loaded the Employer may require the Bidder to provide written clarifications. Clarifications may include detailed price analyses to demonstrate the consistency of the Bid prices with the

[3] An individual firm is considered a domestic bidder for purposes of the margin of preference if it is registered in the country of the Employer, has more than 50 percent ownership by nationals of the country of the Employer, and if it does not subcontract more than 10 percent of the contract price, excluding provisional sums, to foreign contractors. JVs are considered as domestic bidders and eligible for domestic preference only if the individual member firms are registered in the country of the Employer or have more than 50 percent ownership by nationals of the country of the Employer, and the JV shall be registered in the country of the Work is executed. The JV shall not subcontract more than 10 percent of the contract price, excluding provisional sums, to foreign firms. JVs between foreign and national firms will not be eligible for domestic preference.

	scope of works, proposed methodology, schedule and any other requirements of the bidding document. 41.2 After the evaluation of the information and detailed price analyses presented by the Bidder, the Employer may as appropriate: (a) accept the Bid; or (b) require that the amount of the performance security be increased at the expense of the Bidder to a level not exceeding 20% of the Contract price; or (c) reject the Bid.
42. Most Advantageous Bid	42.1 Having compared the evaluated costs of Bids, the Employer shall determine the Most Advantageous Bid. The Most Advantageous Bid is the Bid of the Bidder that meets the Qualification Criteria and whose Bid has been determined to be: (a) substantially responsive to the bidding document; and (b) the lowest evaluated cost.
43. Employer's Right to Accept Any Bid, and to Reject Any or All Bids	43.1 The *Employer* reserves the right to accept or reject any Bid, and to annul the Bidding process and reject all Bids at any time prior to Contract Award, without thereby incurring any liability to Bidders. In case of annulment, all Bids submitted and specifically, Bid Securities shall be promptly returned to the Bidders.
44. Standstill Period	44.1 The Contract shall be awarded not earlier than the expiry of the Standstill Period. The duration of the Standstill Period is **specified in the BDS.** Where only one Bid is submitted, the Standstill Period shall not apply.
45. Notice of Intention to Award	45.1 When a Standstill Period applies, it shall commence when the Employer has transmitted to each Bidder (that has not already been notified that it has been unsuccessful) the Notification of Intention to Award the Contract to the successful Bidder. The Notification of Intention to Award shall contain, at a minimum, the following information: (a) the name and address of the Bidder submitting the successful Bid; (b) the Contract price of the successful Bid; (c) the names of all Bidders who submitted Bids, and their Bid prices as readout, and as evaluated; (d) a statement of the reason(s) the Bid (of the unsuccessful Bidder to whom the letter is addressed) was unsuccessful, unless the price information in c) above already reveals the reason; (e) the expiry date of the Standstill Period; and

	(f) instructions on how to request a debriefing and/or submit a complaint during the standstill period.
J. Award of Contract	
46. Award Criteria	46.1 Subject to ITB 43, the Employer shall award the Contract to the successful Bidder. This is the Bidder whose Bid has been determined to be the Most Advantageous Bid as specified in ITB 42.
47. Notification of Award	47.1 Prior to the expiration of the Bid Validity Period and upon expiry of the Standstill Period, specified in BDS ITB 44.1 or any extension thereof, or upon satisfactorily addressing a complaint that has been filed within the Standstill Period, the Employer shall transmit the Letter of Acceptance to the successful Bidder. The Letter of Acceptance shall specify the sum that the Employer will pay the Contractor in consideration of the execution of the contract (hereinafter, and in the Conditions of Contract and Contract Forms, called "the Contract Price"). 47.2 At the same time, the Employer shall publish the Contract Award Notice which shall contain, at a minimum, the following information: (a) name and address of the Employer; (b) name and reference number of the contract being awarded, and the selection method used; (c) names of all Bidders that submitted Bids, and their Bid prices as read out at Bid opening, and as evaluated; (d) names of all Bidders whose Bids were rejected either as nonresponsive or as not meeting qualification criteria, or were not evaluated, with the reasons therefor; and (e) the name of the successful Bidder, the final total contract price, the contract duration and a summary of its scope. 47.3 The Contract Award Notice shall be published on the Employer's website with free access. 47.4 Until a formal Contract is prepared and executed, the Letter of Acceptance shall not constitute a binding Contract.
48. Debriefing by the Employer	48.1 On receipt of the Employer's Notification of Intention to Award referred to in ITB 45.1, an unsuccessful Bidder has three (3) Business Days to make a written request to the Employer for a debriefing. The Employer shall provide a debriefing to all unsuccessful Bidders whose request is received within this deadline.

	48.2 Where a request for debriefing is received within the deadline, the Employer shall provide a debriefing within five (5) Business Days, unless the Employer decides, for justifiable reasons, to provide the debriefing outside this timeframe. In that case, the standstill period shall automatically be extended until five (5) Business Days after such debriefing is provided. If more than one debriefing is so delayed, the standstill period shall not end earlier than five (5) Business Days after the last debriefing takes place. The Employer shall promptly inform, by the quickest means available, all Bidders of the extended standstill period
	48.3 Where a request for debriefing is received by the Employer later than the three (3)-Business Day deadline, the Employer should provide the debriefing as soon as practicable, and normally no later than fifteen (15) Business Days from the date of publication of Public Notice of Award of contract. Requests for debriefing received outside the three (3)-day deadline shall not lead to extension of the standstill period.
	48.4 Debriefings of unsuccessful Bidders may be done in writing or verbally. The Bidder shall bear their own costs of attending such a debriefing meeting.
49. Signing of Contract	49.1 Promptly upon Notification of Award, the Employer shall send the successful Bidder the Contract Agreement.
	49.2 Within twenty-eight (28) days of receipt of the Contract Agreement, the successful Bidder shall sign, date, and return it to the Employer.
50. Performance Security	50.1 Within twenty-eight (28) days of the receipt of the Letter of Acceptance from the Employer, the successful Bidder shall furnish the Performance Security, in accordance with the General Conditions of Contract, subject to ITB 41.2 (b), using for that purpose the Performance Security, Contract Forms, or another form acceptable to the Employer. If the Performance Security furnished by the successful Bidder is in the form of a bond, it shall be issued by a bonding or insurance company that has been determined by the successful Bidder to be acceptable to the Employer. A foreign institution providing a bond shall have a correspondent financial institution located in the Employer's Country, unless the Employer has agreed in writing that a correspondent financial institution is not required.
	50.2 Failure of the successful Bidder to submit the above-mentioned Performance Security, or to sign the Contract Agreement shall constitute sufficient *grounds* for the annulment of the award and forfeiture of the Bid Security. In that event the Employer may award the Contract to the Bidder offering the next Most Advantageous Bid.
51. Adjudicator	51.1 The Employer proposes the person named **in the BDS** to be appointed as Adjudicator under the Contract, at the hourly fee **specified in the BDS**, plus reimbursable expenses. If the Bidder

	disagrees with this proposal, the Bidder should so state in his Bid. If, in the Letter of Acceptance, the Employer does not agree on the appointment of the Adjudicator, the Employer will request the Appointing Authority designated in the Particular Conditions of Contract (PCC) pursuant to Clause 23.1 of the General Conditions of Contract (GCC), to appoint the Adjudicator.
52. Procurement Related Complaint	52.1 The procedures for making a Procurement-related Complaint are as specified in the BDS.

Section II - Bid Data Sheet (BDS)

A. General	
ITB 1.1	**The reference number of the Request for Bids (RFB) is: GVSCCL/Projects/19 (MLCP)/2017-18** The Employer is***: Greater Visakhapatnam Smart City Corporation Limited.*** The name of the RFB is: Design, Construction, Operation and Maintenance of Mechanized Semi - Automatic Multi Level Car Parking Facility near Jagadamba Junction, Visakhapatnam.
ITB 1.2 (a)	The number and identification of comprising this RFB is: *[insert number]*
ITB 1.2(a)	**Electronic –Procurement System** The Employer shall use the following electronic-procurement system to manage this Bidding process: *https//www.apeprocurement.gov.in.* The electronic-procurement system shall be used to manage the following aspects of the Bidding process: • Technical Proposal containing all the required documents in the required formats. • Financial Proposal: The Priced Bid shall be uploaded through web-portal only.
ITB 4.1	Maximum number of members in the JV shall be: ***3***
ITB 4.7	Not applicable
B. Contents of Bidding Document	
ITB 7.1	For **clarification purposes** only, the Employer's address is: Attention: ***Managing Director, Greater Visakhapatnam Smart City Corporation Limited.*** Address: : c/o Greater Visakhapatnam Municipal Corporation, Room No.306, Asilmetta Junction, Visakhapatnam – 530003 Andhra Pradesh, India Electronic mail address: visakhapatnamsmartcity@gmail.com
ITB 7.1	Requests for clarification should be received by the Employer no later than: ***15***

	days.. Web page: *https//www.apeprocurement.gov.in.*
ITB 7.4	A Pre-Bid meeting ***"shall"*** take place at the following date, time and place: Date:04/10/2017 Time: 11.30 AM Place: ***Managing Director, Greater Visakhapatnam Smart City Corporation Limited.*** Address: : c/o Greater Visakhapatnam Municipal Corporation, Room No.306, Asilmetta Junction, Visakhapatnam – 530003 Andhra Pradesh, India Electronic mail address: visakhapatnamsmartcity@gmail.com
ITB 7.6	Web page: *https//www.apeprocurement.gov.in.*
C. Preparation of Bids	
ITB 10.1	The language of the Bid is: ***English*** All correspondence exchange shall be in ***English*** language. Language for translation of supporting documents and printed literature is ***English***
ITB 11.2 (g)	(a) Experience in works of similar nature and size for each of the last Ten years, and details of works underway or contractually committed with their certificates from the concerned officer not less the rank of Executive Engineer or Equivalent. A list of clients with their contact details, who may be contacted for further information on those contracts, shall also be provided. (b) Major items of construction equipment proposed to carry out the Contract; (c) Qualifications and experience of key site management and technical personnel proposed for Contract; Reports on the financial standing of the Bidder, such as profit and loss statements and auditor's reports for the past five years; (d) Authority may seek references from the Bidder's bankers; (e) Information regarding any litigation, current or during the last Ten years, in which the Bidder is involved, the parties concerned, and disputed Amount

ITB 11.3 (d)	The following schedules shall be submitted with the Bid: ***Construction Schedule*** The Bidder shall submit the following additional documents in its Bid: The following documents shall be submitted in Hard copy at Client office no later than Three working days after opening of Technical Bid without which the ***Bid shall be treated as Non- Responsive and Technical Bid shall not be opened***. (a) Complete set of Technical Bid uploaded in the E-portal shall be hard bound / spiral (not in loose papers). (b) Copies of original documents defining the constitution or legal status, place of registration, and principal place of business; (c) written notarized power of attorney of the signatory to submit the Bid of an appropriate value; (d) Original Bank Guarantee submitted as Earnest Money Deposit for the submission of Bid. (e) Copy of CA certificate as per the Form FIN -3.2 (f) If the Technical Bid hard copy is not submitted, the Bod shall be treated as non-responsive and shall not be evaluated. The Financial Bid shall be submitted in e-portal only.
ITB 13.1	Alternative Bids **shall not** be permitted.
ITB 13.2	Alternative times for completion **shall not** be permitted.
ITB 13.4	Alternative technical solutions shall be permitted for the following parts of the Works: Not Permitted
ITB 14.5	The prices quoted by the Bidder ***shall*** subject to adjustment during the performance of the Contract.
ITB 15.1	The price shall be quoted by the Bidder in: ***Indian Rupees***
ITB 18.1	The Bid validity period shall be ***180***days.
ITB 19.1	A Bid Security ***shall be*** required. A Bid-Securing Declaration ***shall not be*** required. If a Bid Security shall be required, the amount and currency of the Bid Security shall be: INR 65 Lacs (Rupees Sixty Five lakhs Only) in the form of DD/BG/NEFT/RTGS/OTC as mentioned above. DD shall be issued by a Scheduled Bank in India, drawn in favour of the Managing Director, GVSCCL and payable at Visakhapatnam. Bid Processing fee or Transaction Fee shall be 1.85% to be paid vide,

	NEFT/RTGS only. Bid Document Charges shall be INR 20,000 (Rupees Twenty thousand Only)Paid via of DD issued by a Scheduled Bank in India, drawn in favour of the Managing Director, GVSCCL and payable at Visakhapatnam.
ITB 19.3 (d)	Other types of acceptable securities: • ***NEFT/RTGS*** • ***Net Banking*** • ***Over the Counter and any other forms which are provided as per the e-portal.*** • ***Demand Draft*** • ***Bank Guarantee***
ITB 19.9	If the Bidder performs any of the actions prescribed in ITB 19.9 (a) or (b), the Employer will declare the Bidder ineligible to be awarded contracts by the Employer for a period of ***1*** year.
ITB 20.3	The written confirmation of authorization to sign on behalf of the Bidder shall consist of; ***Duly executed Power of Attorney in favour of person who is submitting the Bid***
D. Submission of Bids	
ITB 21.2	In addition to the original of the Bid, the number of copies is: **One.**
ITB 22.1	For **Bid submission purposes** only, the Employer's address is: Street Address: ***Managing Director, Greater Visakhapatnam Smart City Corporation Limited.*** Address: : c/o Greater Visakhapatnam Municipal Corporation, Room No.306, Asilmetta Junction, Visakhapatnam – 530003 Andhra Pradesh, India Date: 20/10/2017 Time: 5.00 PM Bidders ***"shall" mandatorily submit all the copies of the Bid vide web portal.*** The electronic bidding submission procedures shall be: The bidder would be required to register on the e-procurement market place *https//www.apeprocurement.gov.in* and submit their bids online. Bidders are requested to submit the bid in two stages: Stage – I: Eligibility and Technical Bid Stage. Stage – II: Financial Bid Stage. • The first stage will cover the qualifications and eligibility criteria and the technical bid. The bidder shall upload documents in support of the above. The bidder shall submit price bid online under second stage which may include proposals for financing to cover part of the Scope of Work as per bid documents before the bid submission closing date.

	• Bidders shall submit a declaration without any reservation whatsoever that the submitted eligibility and qualification details, Techno-Commercial bid and financial bid are without any deviations and are strictly in conformity with the bid documents issued by the Employer. • Declaration should be given by the bidder for the correctness of the credentials submitted by him. • Bidder should submit the hard copy of Technical proposal on or before 23/10/2017 , 5.0 PM
E. Public Opening of Technical Parts of Bids	
ITB 25.1	The Bid opening shall take place at: Street Address: : ***Managing Director, Greater Visakhapatnam Smart City Corporation Limited.*** Address: : c/o Greater Visakhapatnam Municipal Corporation, Room No.306, Asilmetta Junction, Visakhapatnam – 530003 Andhra Pradesh, India Date: 20/10/2017 Time: 5.30 PM
F. Evaluation of Bids – General Provisions	
ITB 29.3	***Not Applicable***
G. Evaluation of Bids - Technical Parts	
ITB 33.1	At this time the Employer to execute certain specific parts of the Works by subcontractors selected in advance- ***None***
ITB 33.3	Contractor's proposed subcontracting: ***None***
H. Public Opening of Financial Parts	
ITB 34.2 (c)	Following the completion of the evaluation of the Technical Parts of the Bids, the Employer will notify vide the e-protal mentioning of the location, date and time of the public opening of Financial Parts. The Employer shall publish a notice of the public opening of the Financial Parts on its website.
I. Evaluation of Bids - Financial Parts	
ITB 37.1	The currency that shall be used for Bid evaluation and comparison purposes to convert at the selling exchange rate all Bid prices expressed in various currencies into a single currency is: ***Indian Rupees*** The source of exchange rate shall be: ***Reserve Bank of India***

	The date for the exchange rate shall be*: **28 days before the Submission of Bid***
ITB 44 **Standstill Period**	***Not Applicable***
J. Award of Contract	
ITB 51 **Adjudicator**	The Adjudicator proposed by the Employer is***: The Chairman, Institute of Engineers, Andhra Pradesh State Center.***

Section III - Evaluation and Qualification Criteria

Eligibility and Qualification Criteria			Compliance Requirements				Documentation
No.	Subject	Requirement	Single Entity	Joint Venture (existing or intended)			Submission Requirements
				All members Combined	Each member	At least one member	
1. Eligibility							
1.1	Nationality	Nationality in accordance with ITB 4.4	Must meet requirement	Must meet requirement	Must meet requirement	N/A	Forms ELI – 1.1 and 1.2, with attachments
1.2	Conflict of Interest	No conflicts of interest in accordance with ITB 4.2	Must meet requirement	Must meet requirement	Must meet requirement	N/A	Letter of Bid
1.3	Employer Eligibility	Not having been declared ineligible by the Employer, as described in ITB 4.5.	Must meet requirement	Must meet requirement	Must meet requirement	N/A	Letter of Bid
1.4	State-owned enterprise or institution of the Employer's country	Meets conditions of ITB 4.6	Must meet requirement	Must meet requirement	Must meet requirement	N/A	Forms ELI – 1.1 and 1.2, with attachments

Eligibility and Qualification Criteria			Compliance Requirements				Documentation
No.	Subject	Requirement	Single Entity	Joint Venture (existing or intended)			Submission Requirements
				All members Combined	Each member	At least one member	
1.	**Historical Contract Non-Performance**						
2.1	History of Non-Performing Contracts	Non-performance of a contract[1] did not occur as a result of contractor default since August 2017.	Must meet requirement[1 and 2]	Must meet requirements	Must meet requirement[2]	N/A	Form CON-2
2.2	Suspension Based on Execution of Bid/Proposal Securing Declaration by the Employer or withdrawal of the Bid within Bid validity period	Not under suspension based on execution of a Bid/Proposal Securing Declaration or withdrawal of the Bid pursuant ITB 19.9.	Must meet requirement	Must meet requirement	Must meet requirement	N/A	Letter of Bid
2.3	Pending Litigation	Bidder's financial position and prospective long term	Must meet requirement	N/A	Must meet requirement	N/A	Form CON – 2

[1] Non-performance, as decided by the Employer, shall include all contracts where (a) non performance was not challenged by the contractor, including through referral to the dispute resolution mechanism under the respective contract, and (b) contracts that were so challenged but fully settled against the contractor. Non performance shall not include contracts where Employers decision was overruled by the dispute resolution mechanism. Non performance must be based on all information on fully settled disputes or litigation, i.e. dispute or litigation that has been resolved in accordance with the dispute resolution mechanism under the respective contract and where all appeal instances available to the Bidder have been exhausted.

[2] This requirement also applies to contracts executed by the Bidder as JV member.

Eligibility and Qualification Criteria			Compliance Requirements				Documentation
No.	Subject	Requirement	Single Entity	Joint Venture (existing or intended)			Submission Requirements
				All members Combined	Each member	At least one member	
		profitability sound according to criteria established in 3.1 below and assuming that all pending litigation will be resolved against the Bidder					
2.4	Litigation History	No consistent history of court/arbitral award decisions against the Bidder[3] August 2017.	Must meet requirement	Must meet requirement	Must meet requirement	N/A	Form CON – 2
3. Financial Situation and Performance							
3.1	Financial Capabilities	(i) The Bidder shall demonstrate that it has access to, or has available, liquid assets, unencumbered real assets, lines of credit, and other financial means (independent of any contractual advance payment) sufficient to meet the construction cash flow requirements estimated as **INR**	Must meet requirement	Must meet Requirement	Minimum 25% of the Financial Capability	N/A	Form FIN – 3.1, with attachments

[3] The Bidder shall provide accurate information on the letter of Bid about any litigation or arbitration resulting from contracts completed or ongoing under its execution over the last five years. A consistent history of court/arbitral awards against the Bidder or any member of a joint venture may result in disqualifying the Bidder.

Eligibility and Qualification Criteria			Compliance Requirements				Documentation
No.	Subject	Requirement	Single Entity	Joint Venture (existing or intended)			Submission Requirements
				All members Combined	Each member	At least one member	
		180 Lakhs for the subject contract(s) net of the Bidder's other commitments					
		(ii) The audited balance sheets for the last 5 years shall be submitted and must demonstrate the current soundness of the Bidder's financial position and ***shall be a profit making organisation.***	Must meet requirement	N/A	Must meet requirement	N/A	
3.2	Average Annual Construction Turnover	Minimum average annual construction turnover of **INR 650 Lakhs**, certified payments received in any one year for contracts in progress and/or completed within the last 10 years, starting from 1st April 2007 -08 till 31st March 2016-17.	Must meet requirement	Must meet requirement	Minimum 25% of the Financial Capability	N/A	Form FIN – 3.2

Eligibility and Qualification Criteria			Compliance Requirements				Documentation
No.	Subject	Requirement	Single Entity	Joint Venture (existing or intended)			Submission Requirements
				All members Combined	Each member	At least one member	
4. Experience							
4.1 (a)	General Construction Experience	Experience under construction contracts in the role of prime contractor, JV member, nominated sub-contractor, or management contractor for at least the last 10 years, starting from 1st April 2007 -08 till 31st March 2016-17.	Must meet requirement	N/A	Must meet requirement	N/A	Form EXP – 4.1
4.2 (a)	Specific Construction & Contract Management Experience	• (i) A minimum number of similar contracts specified below that have been completed as a prime contractor, joint venture member[4], management contractor or nominated sub-contractor[4] between 1st July 2010 and bid submission deadline:	Must meet requirements	Must meet requirement5	N/A	Must meet the requirements	Form EXP 4.2(a)

[4] For contracts under which the Bidder participated as a joint venture member or sub-contractor, only the Bidder's share, by value, shall be considered to meet this requirement. In the case of JV, the value of contracts completed by its members shall not be aggregated to determine whether the requirement of the minimum value of a single contract has been met. Instead, each contract performed by each member shall satisfy the minimum value of a single contract as required for single entity. In determining whether the JV meets the requirement of total number of contracts, only the number of contracts completed by all members each of value equal or more than the minimum value required shall be aggregated.

Eligibility and Qualification Criteria			Compliance Requirements				Documentation
No.	Subject	Requirement	Single Entity	Joint Venture (existing or intended)			Submission Requirements
				All members Combined	Each member	At least one member	
		• Successful completion of at least one Civil Contract of Construction of a multilevel building of RCC/Steel structure for a minimum of total built up area of 5000 sq feet . • Supplying and installing semi-automatic multi-level car parking system of a minimum of 50 cars in one single project. • Operating and maintaining semi-automatic multi-level car parking system for a minimum of 50 cars for at least 2 year in one single project.					

5. Key Personnel

The Bidder must demonstrate that it will have a suitably qualified (and in adequate numbers) minimum Key Personnel, as described in the table below, that are required to perform the Contract.

The Bidder shall provide details of the Key Personnel and such other Key Personnel that the Bidder considers appropriate, together with their academic qualifications and work experience. The Bidder shall complete the relevant Forms in Section IV, Bidding Forms.

The Contractor shall require the Employer's consent to substitute or replace the Key Personnel (reference the Particular Conditions of Contract 9.1).

S No.	Position / Number of Experts required / Educational Qualifying Criteria	Total Work Experience [years]	Experience In Similar Work [years]
1	Project Manager – 1 B. E. Civil	10 years	3 years
2	Material / Quality Engineer – 1; B.E	7 years	3 years
3	Installation Engineer – 1; B.E (Mech./Elect./Electronics) (Having experience in car parking systems)	7 years	3 years
4	Supervisors – 2; Diploma (Mech./Elect./Electronics/Civil)	5 years	2 years
5	Technicians (ITI) Trained – 2 Nos.	2 years	1 year
6	Operators (ITI) Trained – 3 Nos. (For Day shifts)	1 year	-
7	Operators (ITI) Trained – 2 Nos. (For Night shift)	1 year	-

6. Equipment

The Bidder to demonstrate that it has the key equipment listed hereafter:

No.	Equipment Type and Characteristics	Min. Quantity Required
1	Excavator	1 No.
2	Concrete weigh batchers	1 No.
3	Needle/ plate vibrator	2 No.
4	Tippers	1 No.
5	Total station survey equipment set	1 No.
6	Water tanker (with sprinkling arrangements)	2 No.
7	Tower Crane of suitable capacity	1 No.
8	Generator of suitable capacity	1 No.
9	Laboratory apparatus & equipment as per MoRT&H Standard.	As Required
10	Welding Units	As Required
11	Electrical Testing Kit (Megger, Voltmeter etc. of Various ranges)	As Required
12	Safety Equipment for personnel	As Required

The Bidder may provide further details of proposed items of equipment using Form EQU in Section IV, Bidding Forms.

7. Sub-Contractors

Subcontractors/manufacturers for the following major items of supply or services must meet the following minimum criteria, herein listed for that item. Failure to comply with this requirement will result in rejection of the subcontractor.

Item No.	Description of Item	Minimum Criteria to be met
1	Civil works	Minimum 5 years' experience in construction of RCC/Steel foundation and super structures. Should have constructed civil/steel structures for 5000 sq ft area
2	Mechanical, Electrical and Instrumentation Installations	Minimum 5 years' experience in electrical mechanical installation. Should have worked for mechanical, electrical and instrumentation installations for semi-automatic multilevel car park for a capacity of at least 50 car spaces
3	Operation and maintenance	Minimum 5 years' experience in Operation and maintenance of semi-automatic multilevel car park for a capacity of at least 50 car spaces

The bidder can submit their bids with single or all three subcontractors with qualification as mentioned above.

In the case of a Bidder who offers to supply and install major items of supply under the contract that the Bidder did not manufacture or otherwise produce, the Bidder shall provide the manufacturer's authorization, using the form provided in Section 4 (Bidding Forms), showing that the Bidder has been duly authorized by the manufacturer or producer of the related plant and equipment or component to supply and install that item in the Employer's country. The Bidder is responsible for ensuring that the manufacturer or producer complies with the requirements of ITB 4 and 5 and meets the minimum criteria listed above for that site

Section IV - Bidding Forms

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Letter of Bid – Technical Part

Date of this Bid submission: [*insert date (as day, month and year) of Bid submission*]

Request for Bid No.: [*insert identification*]

To:
The Managing Director,
Greater Visakhapatnam Smart City Corporation Limited
c/o Greater Visakhapatnam Municipal Corporation,
Room No.306, Asilmetta Junction, Visakhapatnam – 530003
Andhra Pradesh, India

We, the undersigned, hereby submit our Bid, in two parts, namely:

(a) the Technical Part, and

(b) the Financial Part

In submitting our Bid, we make the following declarations:

(a) **No reservations:** We have examined and have no reservations to the bidding document, including Addenda issued in accordance with Instructions to Bidders (ITB 8);

(b) **Eligibility**: We meet the eligibility requirements and have no conflict of interest in accordance with ITB 4;

(c) **Bid-Securing Declaration:** We have not been suspended nor declared ineligible by the Employer based on execution of a Bid-Securing Declaration or Proposal-Securing Declaration in the Employer's country in accordance with ITB 4.7;

(d) **Conformity**: We offer to execute in conformity with the bidding document the following Works: [*insert a brief description of the Works*]_____

_____;

(e) **Bid Validity Period**: Our Bid shall be valid for a period specified in BDS 18.1 (or as amended if applicable) from the date fixed for the Bid submission deadline specified in BDS 22.1 (or as amended if applicable), and it shall remain binding upon us and may be accepted at any time before the expiration of that period;

(f) **Performance Security:** If our Bid is accepted, we commit to obtain a Performance Security in accordance with the bidding document;

(g) **One Bid Per Bidder:** We are not submitting any other Bid(s) as an individual Bidder or as a subcontractor, and we are not participating in any other Bid(s) as a Joint Venture member, and meet the requirements of ITB 4.3, other than alternative Bids submitted in accordance with ITB 13;

(h) **State-owned enterprise or institution:** [*select the appropriate option and delete the other*] [*We are not a state-owned enterprise or institution*] / [*We are a state-owned enterprise or institution but meet the requirements of ITB 4.6*];

(i) **Binding Contract**: We understand that this Bid, together with your written acceptance thereof included in your Letter of Acceptance, shall constitute a binding contract between us, until a formal contract is prepared and executed;

(j) **Not Bound to Accept:** We understand that you are not bound to accept the lowest evaluated cost Bid, the Most Advantageous Bid or any other Bid that you may receive; and

(k) **Fraud and Corruption:** We hereby certify that we have taken steps to ensure that no person acting for us or on our behalf engages in any type of Fraud and Corruption;

Name of the Bidder: *[*insert complete name of person signing the Bid*]

Name of the person duly authorized to sign the Bid on behalf of the Bidder: ** [*insert complete name of person duly authorized to sign the Bid*]

Title of the person signing the Bid: [*insert complete title of the person signing the Bid*]

Signature of the person named above: [*insert signature of person whose name and capacity are shown above*]

Date signed [*insert date of signing*] **day of** [*insert month*], [*insert year*]

Date signed _____ day of _____,

*****: In the case of the Bid submitted by joint venture specify the name of the Joint Venture as Bidder

**: Person signing the Bid shall have the power of attorney given by the Bidder to be attached with the Bid

Appendix A to Technical Part: Technical Proposal

Site Organization

[insert Site Organization Information]

Method Statement

[insert Method Statement]

Mobilization Schedule

[insert Mobilization Schedule]

Construction Schedule

[insert Construction Schedule]

Appendix B to Technical Part: Equipment

The Bidder shall provide adequate information to demonstrate clearly that it has the capability to meet the requirements for the key equipment listed in Section III, Evaluation and Qualification Criteria. A separate Form shall be prepared for each item of equipment listed, or for alternative equipment proposed by the Bidder.

Item of equipment		
Equipment information	Name of manufacturer	Model and power rating
	Capacity	Year of manufacture
Current status	Current location	
	Details of current commitments	
Source	Indicate source of the equipment (a) ☐ Owned ☐ Rented ☐ Leased ☐ Specially manufactured	

Omit the following information for equipment owned by the Bidder.

Owner	Name of owner	
	Address of owner	
	Telephone	Contact name and title
	Fax	Telex
Agreements	Details of rental / lease / manufacture agreements specific to the project	

Appendix C to Technical Part: Key Personnel

Form PER -1: Key Personnel

Schedule

Bidders should provide the names and details of the suitably qualified Key Personnel to perform the Contract. The data on their experience should be supplied using the Form PER-2 below for each candidate.

Key Personnel

1.	**Title of position:**	
	Name of candidate:	
	Duration of appointment:	[*insert the whole period (start and end dates) for which this position will be engaged*]
	Time commitment: for this position:	[*insert the number of days/week/months/ that has been scheduled for this position*]
	Expected time schedule for this position:	[*insert the expected time schedule for this position (e.g. attach high level Gantt chart*]
2.	**Title of position:**	
	Name of candidate:	
	Duration of appointment:	[*insert the whole period (start and end dates) for which this position will be engaged*]
	Time commitment: for this position:	[*insert the number of days/week/months/ that has been scheduled for this position*]
	Expected time schedule for this position:	[*insert the expected time schedule for this position (e.g. attach high level Gantt chart*]
3.	**Title of position:**	
	Name of candidate:	
	Duration of appointment:	[*insert the whole period (start and end dates) for which this position will be engaged*]
	Time commitment: for this position:	[*insert the number of days/week/months/ that has been scheduled for this position*]

	Expected time schedule for this position:	[*insert the expected time schedule for this position (e.g. attach high level Gantt chart*]
4.	**Title of position:**	
	Name of candidate:	
	Duration of appointment:	[*insert the whole period (start and end dates) for which this position will be engaged*]
	Time commitment: for this position:	[*insert the number of days/week/months/ that has been scheduled for this position*]
	Expected time schedule for this position:	[*insert the expected time schedule for this position (e.g. attach high level Gantt chart*]
5.	**Title of position:** *[insert title]*	
	Name of candidate	
	Duration of appointment:	[*insert the whole period (start and end dates) for which this position will be engaged*]
	Time commitment: for this position:	[*insert the number of days/week/months/ that has been scheduled for this position*]
	Expected time schedule for this position:	[*insert the expected time schedule for this position (e.g. attach high level Gantt chart*]

Form PER-2: Resume and Declaration

Key Personnel

Name of Bidder:

Position [#*1*]: [*title of position from Form PER-1*]		
Personnel information	**Name:**	**Date of birth:**
	Address:	**E-mail:**
	Professional qualifications:	
	Academic qualifications:	
	Language proficiency: *[language and levels of speaking, reading and writing skills]*	
Details	**Address of employer:**	
	Telephone:	**Contact (manager / personnel officer):**
	Fax:	
	Job title:	**Years with present employer:**

Summarize professional experience in reverse chronological order. Indicate particular technical and managerial experience relevant to the project.

Project	**Role**	**Duration of involvement**	**Relevant experience**
[main project details]	*[role and responsibilities on the project]*	*[time in role]*	*[describe the experience relevant to this position]*

Declaration

I, the undersigned Key Personnel, certify that to the best of my knowledge and belief, the information contained in this Form PER-2 correctly describes myself, my qualifications and my experience.

I confirm that I am available as certified in the following table and throughout the expected time schedule for this position as provided in the Bid:

Commitment	**Details**
Commitment to duration of contract:	*[insert period (start and end dates) for which this Key Personnel is available to work on this contract]*
Time commitment:	*[insert the number of days/week/months/ that this Key Personnel will be engaged]*

I understand that any misrepresentation or omission in this Form may:

(a) be taken into consideration during Bid evaluation;

(b) my disqualification from participating in the Bid;

(c) my dismissal from the contract.

Name of Key Personnel: [*insert name*]

Signature: _____

Date: (day month year): _____

Countersignature of authorized representative of the Bidder:

Signature: _____

Date: (day month year): _____

Appendix D to Technical Part: Bidder's Qualification

To establish its qualifications to perform the contract in accordance with Section III (Evaluation and Qualification Criteria) the Bidder shall provide the information requested in the corresponding Information Sheets included hereunder.

Form ELI - 1.1

Bidder Information Form

Date: _____
RFB No. and title: _____
Page _____of _____pages

Bidder's name
In case of Joint Venture (JV), name of each member:
Bidder's actual or intended country of registration: *[indicate country of Constitution]*
Bidder's actual or intended year of incorporation:
Bidder's legal address [in country of registration]:
Bidder's authorized representative information Name: _____ Address: _____ Telephone/Fax numbers: _____ E-mail address: _____
1. Attached are copies of original documents of ☐ Articles of Incorporation (or equivalent documents of constitution or association), and/or documents of registration of the legal entity named above, in accordance with ITB 4.4. ☐ In case of JV, letter of intent to form JV or JV agreement, in accordance with ITB 4.1. ☐ In case of state-owned enterprise or institution, in accordance with ITB 4.6 documents establishing: • Legal and financial autonomy • Operation under commercial law • Establishing that the Bidder is not under the supervision of the Employer 2. Included are the organizational chart, a list of Board of Directors, and the beneficial ownership.

Form ELI -1.2

Bidder's JV Information Form
(to be completed for each member of Bidder's JV)

Date: _____
RFB No. and title: _____
Page _____ of _____ pages

Bidder's JV name:
JV member's name:
JV member's country of registration:
JV member's year of constitution:
JV member's legal address in country of constitution:
JV member's authorized representative information Name: _____ Address: _____ Telephone/Fax numbers: _____ E-mail address: _____
1. Attached are copies of original documents of ☐ Articles of Incorporation (or equivalent documents of constitution or association), and/or registration documents of the legal entity named above, in accordance with ITB 4.4. ☐ In case of a state-owned enterprise or institution, documents establishing legal and financial autonomy, operation in accordance with commercial law, and that they are not under the supervision of the Employer, in accordance with ITB 4.6. 2. Included are the organizational chart, a list of Board of Directors, and the beneficial ownership.

Form CON – 2

Historical Contract Non-Performance, Pending Litigation and Litigation History

Bidder's Name: _____
Date: _____
JV Member's Name_____
RFB No. and title: _____
Page _____of _____pages

Non-Performed Contracts in accordance with Section III, Evaluation and Qualification Criteria			
☐ Contract non-performance did not occur since 1st January *[insert year]* specified in Section III, Evaluation and Qualification Criteria, Sub-Factor 2.1. ☐ Contract(s) not performed since 1st January *[insert year]* specified in Section III, Evaluation and Qualification Criteria, requirement 2.1			
Year	**Non-performed portion of contract**	**Contract Identification**	**Total Contract Amount (current value, currency, exchange rate and INR equivalent)**
[insert year]	*[insert amount and percentage]*	Contract Identification: *[indicate complete contract name/ number, and any other identification]* Name of Employer: *[insert full name]* Address of Employer: *[insert street/city/country]* Reason(s) for non-performance: *[indicate main reason(s)]*	*[insert amount]*
Pending Litigation, in accordance with Section III, Evaluation and Qualification Criteria			
☐ No pending litigation in accordance with Section III, Evaluation and Qualification Criteria, Sub-Factor 2.3. ☐ Pending litigation in accordance with Section III, Evaluation and Qualification Criteria, Sub-Factor 2.3 as indicated below.			

Year of dispute	Amount in dispute (currency)	Contract Identification	Total Contract Amount (currency), INR Equivalent (exchange rate)
		Contract Identification: _____ Name of Employer: _____ Address of Employer: _____ Matter in dispute: _____ Party who initiated the dispute: ____ Status of dispute: _____	
		Contract Identification: Name of Employer: Address of Employer: Matter in dispute: Party who initiated the dispute: Status of dispute:	

Litigation History in accordance with Section III, Evaluation and Qualification Criteria

☐ No Litigation History in accordance with Section III, Evaluation and Qualification Criteria, Sub-Factor 2.4.

☐ Litigation History in accordance with Section III, Evaluation and Qualification Criteria, Sub-Factor 2.4 as indicated below.

Year of award	Outcome as percentage of Net Worth	Contract Identification	Total Contract Amount (currency), INR Equivalent (exchange rate)
[insert year]	*[insert percentage]*	Contract Identification: [indicate complete contract name, number, and any other identification] Name of Employer: *[insert full name]* Address of Employer: *[insert street/city/country]* Matter in dispute: *[indicate main issues in dispute]* Party who initiated the dispute: *[indicate "Employer" or "Contractor"]* Reason(s) for Litigation and award decision *[indicate main reason(s)]*	*[insert amount]*

Form FIN – 3.1

Financial Situation and Performance

Bidder's Name: _____
Date: _____
JV Member's Name_____
RFB No. and title: _____
Page _____of _____pages

1. Financial data#

Type of Financial information in (currency)	**Historic information for previous _____*years*, _____ (amount in currency, currency, exchange rate*, in INR equivalent)**				
	Year 1	**Year 2**	**Year 3**	**Year4**	**Year 5**
Statement of Financial Position (Information from Balance Sheet)					
Total Assets (TA)					
Total Liabilities (TL)					
Total Equity/Net Worth (NW)					
Current Assets (CA)					
Current Liabilities (CL)					
Working Capital (WC)					
Information from Income Statement					
Total Revenue (TR)					
Profits Before Taxes (PBT)					
Cash Flow Information					
Cash Flow from Operating Activities					

*Refer to ITB 15 for the exchange rate

The Financial Certificate shall be certified by the Chartered Accountant.

2. Sources of Finance

Specify sources of finance to meet the cash flow requirements on works currently in progress and for future contract commitments.

No.	Source of finance	Amount (INR equivalent)
1		
2		
3		

2. Financial documents

The Bidder and its parties shall provide copies of financial statements for _____years pursuant Section III, Evaluation and Qualifications Criteria, Sub-factor 3.1. The financial statements shall:

(a) reflect the financial situation of the Bidder or in case of JV member, and not an affiliated entity (such as parent company or group member).

(b) be independently audited or certified in accordance with local legislation.

(c) be complete, including all notes to the financial statements.

(d) correspond to accounting periods already completed and audited.

☐ Attached are copies of financial statements[9] for the _____years required above; and complying with the requirements

[9] If the most recent set of financial statements is for a period earlier than 12 months from the date of bid, the reason for this should be justified.

Form FIN – 3.2:

Average Annual Construction Turnover

(See Section III, Evaluation and Qualification Criteria, Sub-Factor 3.2)

Bidder's Name: _____
Date: _____

S. No.	Financial Year	Annual Construction Turnover (INR Crore)
1	Financial Year 2007-08	
2	Financial Year 2008-09	
3	Financial Year 2009-10	
4	Financial Year 2010-11	
5	Financial Year 2011-12	
6	Financial Year 2012-13	
7	Financial Year 2013-14	
8	Financial Year 2014-15	
9	Financial Year 2015-16	
10	Financial Year 2016-17	

Note: The audited Financial Statements for the corresponding year has to be attached.

Name of the auditor issuing the certificate

Name of the auditor's Firm:

Seal of the auditor's Firm:

Date:

(Signature, name and designation of the authorised signatory for the Auditor's Firm)

* See Section III, Evaluation and Qualification Criteria, Sub-Factor 3.2.

Form FIN – 3.3

Financial Resources

Specify proposed sources of financing, such as liquid assets, unencumbered real assets, lines of credit, and other financial means, net of current commitments, available to meet the total construction cash flow demands of the subject contract or contracts as specified in Section III (Evaluation and Qualification Criteria)

Financial Resources		
No.	**Source of financing**	**Amount (INR equivalent)**
1		
2		
3		

Form FIN – 3.4

Current Contract Commitments / Works in Progress

Bidders and each member to a JV should provide information on their current commitments on all contracts that have been awarded, or for which a letter of intent or acceptance has been received, or for contracts approaching completion, but for which an unqualified, full completion certificate has yet to be issued.

Current Contract Commitments					
No.	**Name of Contract**	**Employer's Contact Address, Tel, Fax**	**Value of Outstanding Work [Current INR Equivalent]**	**Estimated Completion Date**	**Average Monthly Invoicing Over Last Six Months [INR month)]**
1					
2					
3					
4					
5					

Form EXP - 4.1

General Construction Experience

Bidder's Name: _____
Date: _____
JV Member's Name_____
RFB No. and title: _____
Page _____of _____pages

Starting Year	Ending Year	Contract Identification	Role of Bidder
		Contract name: _____ Brief Description of the Works performed by the Bidder: _____ Amount of contract: _____ Name of Employer: _____ Address: _____	
		Contract name: _____ Brief Description of the Works performed by the Bidder: _____ Amount of contract: _____ Name of Employer: _____ Address: _____	
		Contract name: _____ Brief Description of the Works performed by the Bidder: _____ Amount of contract: _____ Name of Employer: _____ Address: _____	

Form EXP - 4.2(a)

Specific Construction and Contract Management Experience

Bidder's Name: _____
Date: _____
JV Member's Name_____
RFB No. and title: _____
Page _____of _____pages

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

Form EXP - 4.2(a) (cont.)

Specific Construction and Contract Management Experience (cont.)

Similar Contract No.	Information
Description of the similarity in accordance with Sub-Factor 4.2(a) of Section III:	
1. Amount	
2. Physical size of required works items	
3. Complexity	
4. Methods/Technology	
5. Construction rate for key activities	
6. Other Characteristics	

Form EXP - 4.2(b)

Construction Experience in Key Activities

Bidder's Name: _____
Date: _____
Bidder's JV Member Name: _____
Sub-contractor's Name[10] (as per ITB 34.2 and 34.3): _____
RFB No. and title: _____

Page _____of _____pages

All Sub-contractors for key activities must complete the information in this form as per ITB 33.2 and 33.3 and Section III, Qualification Criteria and Requirements, Sub-Factor 4.2.

1. Key Activity No One: _____

	Information			
Contract Identification				
Award date				
Completion date				
Role in Contract	Prime Contractor ☐	Member in JV ☐	Management Contractor ☐	Sub-contractor ☐
Total Contract Amount			INR	
Quantity (Volume, number or rate of production, as applicable) performed under the contract per year or part of the year	Total quantity in the contract (i)	Percentage Participation (ii)		Actual Quantity Performed (i) x (ii)
Year 1				
Year 2				
Year 3				
Year 4				
Employer's Name:				

[10] If applicable

	Information
Address: Telephone/fax number E-mail:	

2. Activity No. Two

3. ……

	Information
Description of the key activities in accordance with Sub-Factor 4.2(b) of Section III:	

Letter of Bid - Financial Part

Date of this Bid submission: [*insert date (as day, month and year) of Bid submission*]

Request for Bid No.: [*insert identification*]

To:
The Managing Director,
Greater Visakhapatnam Smart City Corporation Limited
c/o Greater Visakhapatnam Municipal Corporation,
Room No.306, Asilmetta Junction, Visakhapatnam – 530003
Andhra Pradesh, India

We, the undersigned, hereby submit the second part of our Bid, the Bid Price and Bill of Quantities. This accompanies the Letter of Technical Part.

In submitting our Bid, we make the following additional declarations:

(a) **Bid Validity Period**: Our Bid shall be valid for a period specified in BDS 18.1 (or as amended if applicable) from the date fixed for the Bid submission deadline specified in BDS 22.1 (or as amended if applicable), and it shall remain binding upon us and may be accepted at any time before the expiration of that period;

(b) **Total Price**: The total price of our Bid, excluding any discounts offered in item (f) below is: [Insert one of the options below as appropriate]

Total price is: [*insert the total price of the Bid in words and figures, indicating the various amounts and the respective currencies*];

(c) **Discounts:** The discounts offered and the methodology for their application are:

(i) The discounts offered are: [*Specify in detail each discount offered*]

(ii) The exact method of calculations to determine the net price after application of discounts is shown below: [*Specify in detail the method that shall be used to apply the discounts*];

(d) **Commissions,** gratuities **and fees:** We have paid, or will pay the following commissions, gratuities, or fees with respect to the Bidding process or execution of the Contract: [*insert complete name of each Recipient, its full address, the reason for which each commission or gratuity was paid and the amount and currency of each such commission or gratuity*].

Name of Recipient	Address	Reason	Amount

(If none has been paid or is to be paid, indicate "none.")

Name of the Bidder:*[*insert complete name of person signing the Bid*]

Name of the person duly authorized to sign the Bid on behalf of the Bidder: ** [*insert complete name of person duly authorized to sign the Bid*]

Title of the person signing the Bid: [*insert complete title of the person signing the Bid*]

Signature of the person named above: [*insert signature of person whose name and capacity are shown above*]

Date signed [*insert date of signing*] **day of** [*insert month*], [*insert year*]

*****: In the case of the Bid submitted by a Joint Venture specify the name of the Joint Venture as Bidder.

**: Person signing the Bid shall have the power of attorney given by the Bidder. The power of attorney shall be attached with the Bid Schedules

Price Schedules

PREAMBLE

General

1. The Price Schedules are divided into separate Schedules as follows:

   Schedule No. 1: Plant (including Mandatory Spare Parts) Supplied from Abroad

   Schedule No. 2: Plant (including Mandatory Spare Parts) Supplied from within the Employer's Country

   Schedule No. 3: Installation and Other Services

   Schedule No. 4: Design Services

   Schedule No. 5: Civil Works

   Schedule No. 6: Grand Summary of Plant and installation

   Schedule No. 7: Operation and Maintenance

2. The Schedules do not generally give a full description of the plant to be supplied and the services to be performed under each item. Bidders shall be deemed to have read the Employer's Requirements and other sections of the Bidding Document and reviewed the Drawings to ascertain the full scope of the requirements included in each item prior to filling in the rates and prices. The entered rates and prices shall be deemed to cover the full scope as aforesaid, including overheads and profit.

3. If bidders are unclear or uncertain as to the scope of any item, they shall seek clarification in accordance with ITB 7 prior to submitting their bid.

Pricing

4. Prices shall be filled in indelible ink, and any alterations necessary due to errors, etc., shall be initialed by the Bidder.

   As specified in the Bid Data Sheet and Special Conditions of Contract, prices shall be fixed and firm for the duration of the Contract, or prices shall be subject to adjustment in accordance with the corresponding Appendix (Price Adjustment) to the Contract Agreement.

5. Bid prices shall be quoted in the manner indicated and in the currencies specified in the Instructions to Bidders in the Bidding Document.

   For each item, bidders shall complete each appropriate column in the respective Schedules, giving the price breakdown as indicated in the Schedules.

   Prices given in the Schedules against each item shall be for the scope covered by that item as detailed in Section 6 (Employer's Requirements) or elsewhere in the Bidding Document.

6. Payments will be made to the Contractor in the currency or currencies indicated under each respective item.

7. When requested by the Employer for the purposes of making payments or part payments, valuing variations or evaluating claims, or for such other purposes as the Employer may reasonably require, the Contractor shall provide the Employer with a breakdown of any composite or lump sum items included in the Schedules.

Greater Visakhapatnam Smart City Corporation Limited (GVSCCL)

Package Name: **Design, Construction, Operation and Maintenance of Mechanized Semi - Automatic Multi Level Car Parking Facility near Jagadamba Junction, Visakhapatnam.**

Bill of Quantities

Price Schedule No. 1 - Plant and Equipment's Supplied from Abroad

Item	Description	Country of Origin	Unit	Qty.	Unit Price[1]		Total Price[1]			
					Foreign Currency	CIF	Amount in Foreign Currency	Rate of Exchange	Amount in Equivalent Local Currency	
									In Figures	
1	2	3	4	5	6	7	8 = 5 x 7	9	10 = 8 x 9	
	List of items to be included by the bidder				Not to be quoted here (The rates are to be quoted in Price Bid only)					
	TOTAL of Column 10 to be carried over to Grand Summary									

Signature of Bidder_____

Name of Bidder _____

[1] ***Specify currencies in accordance with ITB 19.***

Country of Origin Declaration Form

Item	Description	Country

Price Schedule No.: 2 Supply of Equipment / Items from within the Employer's Country

S. No.	Description of Item	Quantity	EXW Unit Price[1]	Total EXW Price[1]	Sales Tax	Total Price
1	2	3	4	5=3x4	6	7=5+6
1	Supply of Mechanical equipment / items for Water Supply, Sanitary & Plumbing works for the entire premises including office block.	1 Job	Not to be quoted here	Not to be quoted here	Not to be quoted here	Not to be quoted here
2	Supply of steel and other allied components / items for Car Parking System for 110 cars.	1 Job				
3	Supply of Mechanical equipment / items for Fire Fighting Management System for the entire premises including office block.	1 Job				
4	Supply of equipment / items for all Electrical works including D.G. sets and HVAC systems for the entire premises including office block.	1 Job				
5	Supply of Instrumentations, Soft-wares and Control Equipment for all the Works including Car Parking Management System	1 Job				
6	Supply of equipment / items for works not covered above but required for the completion of the works for the entire premises including office block.	1 Job				
	TOTAL of Column 4 (To be carried over to Grand Summary)					

Note: After signing of the contract, Contractor will submit the cost breakup of all items of BOQ which will be approved by the GVSCCL. This cost break up will be used for payment purposes only.

Signature of Bidder_____

Name of Bidder _____

[1] ***Prices to be quoted in local currency.***

Price Schedule No.: 3 Installation of Equipment / Items

S. No.	Description of Item	Quantity	Amount (INR) In Figures
1	2	3	4
1	Installation of Mechanical equipment / items for Water Supply, Sanitary & Plumbing works for the entire premises including office block.	1 Job	Not to be quoted here (The rates are to be quoted in Price Bid only)
2	Installation of Entire 7 level (Ground + 6) Car Parking System (parking capacity for 110 cars)	1 Job	
3	Installation of Mechanical equipment / items for Fire Fighting Management System for the entire premises including office block.	1 Job	
4	Installation of equipment / items for all Electrical works including D.G. sets and HVAC systems for the entire premises including office block.	1 Job	
5	Installation of Instrumentations, Soft-wares and Control Equipment for all the Works including Car Parking Management System.	1 Job	
6	Installation of equipment / items for works not covered above for the entire premises including office block.	1 Job	
	TOTAL of Column 4 (To be carried over to Grand Summary)		

Note: After signing of the contract, Contractor will submit the cost breakup of all items of BOQ which will be approved by the GVSCCL. This cost break up will be used for payment purposes only.

Signature of Bidder_____

Name of Bidder _____

Price Schedule No.: 4 Design Services

S. No.	Description of Item	Quantity	Amount (INR) In Figures
1	2	3	4
1	All Designs and drawings of Civil components.	1 Job	Not to be quoted here (The rates are to be quoted in Price Bid only)
2	All Designs and drawings of Mechanical components for water supply, sanitary and Plumbing works.	1 Job	
3	All Designs and drawings of the semi-automatic puzzle car parking systems	1 Job	
4	All Designs and drawings of Mechanical components for Fire Fighting System.	1 Job	
5	All Designs and drawings of Electrical works including D.G. sets and HVAC systems.	1 Job	
6	All Designs and drawings of Instrumentations, Soft-wares, and Control Equipment for all the Works including Car Management System.	1 Job	
7	All documents related to Operation, Maintenance and Training.	1 Job	
8	As – Built Drawings of all the components of the Facility.	1 Job	
	TOTAL of Column 4 (To be carried over to Grand Summary)		

Signature of Bidder_____

Name of Bidder _____

Price Schedule No.: 5 Civil Works

S. No.	Description of Item	Quantity	Amount (INR) In Figures
1	2	3	4
1	Construction of foundation and underground RCC structures for the entire car parking area for 90 car spaces.	1 Job	Not to be quoted here (The rates are to be quoted in Price Bid only)
2	All works (Civil/Mechanical/Electrical) required for Rain Water Harvesting System.	1 Job	
3	All works required for construction of Road works and Pathways including Road Appurtenances.	1 Job	
4	3 side Cladding on ground floor and 4 side Cladding for balance parking levels of Puzzle Parking Systems.	1 Job	
5	Commissioning and Tests of all equipment / system in the Facility.	1 Job	
	TOTAL of Column 4 (To be carried over to Grand Summary)		

Signature of Bidder_____

Name of Bidder _____

Price Schedule 6 - Grand Summary of Plant and Installation

Schedule No.	**Title**	**Amount In Words**	**Amount INR**
1	Plant and Equipment's Supplied from Abroad	Not to be quoted here (The rates are to be quoted in Price Bid only)	Not to be quoted here (The rates are to be quoted in Price Bid only)
2	Supply of Equipment / Items from within the Employer's Country		
3	Installation of Equipment / Items		
4	Design Services		
5	Civil Works		
GRAND TOTAL			

Signature of Bidder_____

Name of Bidder _____

Price Schedule No.: 7 Operation & Maintenance Services

S. No.	Description of Item	Unit	Quantity	Premium Rate to be paid to GVSCCL/GVMC Rate per Unit (INR) * In Figures	Amount (INR)
1	2	3	4	5	6 = 4 x 5
A	Operation and Maintenance Services:			Not to be quoted here (The rates are to be quoted in Price Bid only)	
I	First year	Year	1		
Ii	Second year	Year	1		
Iii	Third Year	Year	1		
Iv	Fourth Year	Year	1		
V	Fifth Year	Year	1		
Vi	Sixth Year	Year	1		
Vii	Seventh Year	Year	1		
Viii	Eight Year	Year	1		
Ix	Ninth Year	Year	1		
X	Tenth Year	Year	1		
	TOTAL of Column 6 (To be carried over to Grand Summary)				

*Quoted premium to be paid to GVSCCL/GVMC shall be minimum INR 10, 00,000 with year on increment of 5%.

Signature of Bidder_____

Name of Bidder _____

Section V - Eligible Countries

Eligibility of Procurement for the Provision of Goods, Works and Non-consulting Services in the projects financed by Government of India and/or State Government of Andhra Pradesh

In reference to ITB 4.8 and ITB 5.1, the bidders are requested to check the eligibilities of the countries for procurement of goods, works and Non-consulting Services whether declared prohibited/ ineligible for trade and/or procurement by the Government of India (GoI). During the Contract agreement, if at any time GoI declares the prohibition of trade/procurement of goods, works, Non-consulting services from country/countries, the same shall be applicable w.e.f. the date of enforcement declared by the Government of India

Section VI - Fraud and Corruption

6.1 The Bidders and their respective officers, employees, agents and advisers shall observe the highest standard of ethics during the Bidding Process and subsequent to the issue of the Letter of Acceptance and/or Letter of Award and during the subsistence of the Contract Agreement. Notwithstanding anything to the contrary contained herein, or in the Letter of Acceptance and/or Letter of Award or the Contract Agreement, the Employer shall reject a Bid, withdraw the Letter of Acceptance and/or Letter of Award, or terminate the Contract Agreement, as the case may be, without being liable in any manner whatsoever to the Bidder or Contractor or Concessionaire, as the case may be, if it determines that the Bidder or Contractor or Concessionaire, as the case may be, has, directly or indirectly or through an agent, engaged in corrupt practice, fraudulent practice, coercive practice, undesirable practice or restrictive practice in the Bidding Process. In such an event, the Employer shall forfeit and appropriate the Bid Security or Performance Security, as the case may be, as mutually agreed genuine pre-estimated compensation and damages payable to the Employer towards, inter alia, time, cost and effort of the Employer, without prejudice to any other right or remedy that may be available to the Employer hereunder or otherwise.

6.2 Without prejudice to the rights of the Employer under Clause 6.1 hereinabove and the rights and remedies which the Employer may have under the Letter of Acceptance and/or Letter of Award or the Contract Agreement, if a Bidder or contractor or Concessionaire, as the case may be, is found by the Employer to have directly or indirectly or through an agent, engaged or indulged in any corrupt practice, fraudulent practice, coercive practice, undesirable practice or restrictive practice during the Bidding Process, or after the issue of the Letter of Acceptance and/or Letter of Award or the Contract Agreement or the execution of the Contract Agreement, such Bidder or Contractor or Concessionaire shall not be eligible to participate in any tender or RFP issued by the Employer during a period of 2 (two) years from the date such Bidder or Contractor or Concessionaire, as the case may be, is found by the Employer to have directly or indirectly or through an agent, engaged or indulged in any corrupt practice, fraudulent practice, coercive practice, undesirable practice or restrictive practices, as the case may be.

6.3 For the purposes of this Clause 6, the following terms shall have the meaning hereinafter respectively assigned to them:

(a) "corrupt practice" means (i) the offering, giving, receiving, or soliciting, directly or indirectly, of anything of value to influence the actions of any person connected with the Bidding Process (for avoidance of doubt, offering of employment to or employing or engaging in any manner whatsoever, directly or indirectly, any official of the Employer who is or has been associated in any manner, directly or indirectly with the Bidding Process or the Letter of Acceptance and/or Letter of Award or has dealt with matters concerning the Contract Agreement or arising therefrom, before or after the execution thereof, at any time prior to the expiry of one year from the date such official resigns or retires from or otherwise ceases to be in the service of the Employer, shall be deemed to constitute influencing the actions of a person connected with the Bidding Process); or (ii) engaging in any manner whatsoever, whether during the Bidding Process or after the issue of the Letter of Acceptance and/or Letter of Award or after the execution of the Contract Agreement, as the case may be, any person in respect of any matter relating to the Project or the Letter of Acceptance and/or Letter of Award or the Contract Agreement, who at any

time has been or is a legal, financial or technical adviser of the Employer in relation to any matter concerning the Project;

(b) "fraudulent practice" means a misrepresentation or omission of facts or suppression of facts or disclosure of incomplete facts, in order to influence the Bidding Process ;

(c) "coercive practice" means impairing or harming, or threatening to impair or harm, directly or indirectly, any person or property to influence any person's participation or action in the Bidding Process;

(d) "undesirable practice" means (i) establishing contact with any person connected with or employed or engaged by the Employer with the objective of canvassing, lobbying or in any manner influencing or attempting to influence the Bidding Process; or (ii) having a Conflict of Interest; and

(e) "Restrictive practice" means forming a cartel or arriving at any understanding or arrangement among Bidders with the objective of restricting or manipulating a full and fair competition in the Bidding Process.

Section VII – Employer's Requirement

Section VII – Employer's Requirement

This Section-VII contains the Scope of Services, Specifications of Work, Supplementary Information , Drawings, Personnel Requirement and Equipment Requirements.

It is recommended that the bidders physically visit the site of the proposed work before bidding in order to assess the quantum and nature of works.

Table of Contents

7.1 SCOPE OF SERVICES…….

Annexure – A: Scope of Works for Civil and Steel Components including Sanitary & Plumbing works, Drainage & Sewage Works, Road Works

Annexure – B: Scope of Works for Mechanical Components including Fire Fighting & Car Parking System

Annexure – C: Scope of Works for Electrical Components and HVAC (Heating, Ventilation and Air Conditioning System)

Annexure – D: Scope of Works for Car Parking Management System and Instrumentation

Annexure – E: Scope of Works for Operation & Maintenance

7.2 SPECIFICATIONS…….…….

7.2.1 Technical Specifications

7.2.2 Operation and Management Requirement .....

7.3 Drawings ……..……

7.4 Supplementary Information ……..

7.5 Personnel Requirement ..……..……..……

7.6 Equipment Requirement…….…….……..

7.1 SCOPE OF SERVICES

1.1 Preamble

1.1.1 The Overall objective of the Construction of Car Parking Facility near Jagadamba, Visakhapatnam, is to bring about decongestion of traffic in the adjoining area of city by reducing on street parking. This will not only help in providing safe, secure and efficient vehicular circulation / passage but will also enhance public safety & security. The proposed car parking facility is to be constructed Smart city proposals Visakhapatnam. The bidder has to quote for Design, Construction, Operation and Maintenance of Mechanized Semi - Automatic Multi Level Car Parking Facility near Jagadamba Junction, Visakhapatnam for 110 car spaces. The broader Scope of Services to be provided by the Contractor under this Contract is as follows:

Planning & Design **of Civil for the foundation of the puzzle parking systems and for the construction of the pit wherever the puzzle parking systems are recommended building and planning & design for Civil / Steel Structure for the entire building including Plumbing, Drainage & Sewage, Rain Water Harvesting, Landscaping, Mechanical, Fire Prevention & Fire Fighting, Car Parking System, Electrical, HVAC, Car Parking Management and Instrumentation Components for Semi-Automatic Car Parking Facility.**

Construction of Facility **including Civil, Plumbing, Drainage & Sewage, Road, Rain Water Harvesting, Landscaping, Mechanical, Fire Prevention & Fire Fighting, Car Parking System, Electrical, HVAC, Car Parking Management and Instrumentation Components,**

Operation & Maintenance of whole Facility **for Ten (10) years after the date of commissioning including the defect liability period of two year. However during defect liability period the cost of Operation (Operational manpower namely operators , watch and ward, traffic regulators, health and safety, fuel and lubricants for DG sets, or any other requirement to Operate the system 24x7 shall be borne by the contractor) The electricity and water supply charges shall be paid by the contractor during Operation and maintenance period.**

Conducting Training Program **during 6 months of last year of Operation & Maintenance for the staff of GVSCCL/GVMC/Authorised agency by GVSCCL.**

The eligible payments for *Planning, Design and Construction* of all the components of this Facility shall be reimbursed to the Contractor by GVSCCL and the *Cost of Operation & Maintenance* for Ten (10) years shall be reimbursed to the Contractor as per the price schedule.

1.1.2 The general Scope of Services described hereunder is neither exhaustive nor complete and is indicative only. The Contractor shall undertake its own detailed investigations regarding the to-be-built Facility to determine the complete Scope of Services for performance of all obligations as stipulated in various clauses of this Bid Document.

1.1.3. The Scope of Services shall include all technical, managerial, administrative, commercial, environmental, and social interventions as required in accordance with all the provisions of this Bid Document and good engineering and management practices ensuring safe and secure parking solutions to the end users.

1.2 Definitions

The words, terms and expressions beginning with capital letters and defined under this Section 7, Clause 1.2 including those in Section 8 - General Conditions of Contract and those in Section 9 – Particular Conditions of Contract shall, unless the context otherwise requires, have the meanings ascribed thereto / herein :

"BIS" means Bureau of Indian Standard Specification;
"BOQ" means Bill of Quantity;
"Contract Commencement Date" shall mean the date on which the Contract Agreement is signed and Design Services shall be commenced by the Contractor.
"Commissioning Date" shall mean the date on which the created Facility is commissioned for the purpose of use.
"Construction Completion Date" shall mean the date on which the Construction of Facility is complete in all respects and the Facility is commissioned.
"Construction Period" shall mean the period commencing from the Site Takeover Date and up to the Construction Completion Date;
"Contract Completion Date" shall mean the date on which all the Contractual obligations (including Operation & Maintenance Period) will be completed by the Contractor and the Contract expires.
"Contract Period or Total Contract Period" means the period of Contract spread over 11 years from the Commencement Date up to the Contract Completion Date;
"Contractor Personnel" means those personnel hired and deployed by the Contractor for the purpose of fulfilling his contractual obligations.
"CPHEEO" means the Central Public Health and Environmental Engineering Organization under the Ministry of Urban Development, Government of India;
"Design Period" is the period of Contract commencing on the Commencement Date and up to a maximum of 60 days, during which time the Contractor will prepare and get approved his Planning, Design and Drawings of all components of work necessary for construction of the Facility under this contract.
"Project Management consultant" means the agency appointed by the Employer to provide design and construction supervision services under a separate Contract;
"DLP" means Defects Liability Period, which for this contract is 2 year after the successful commissioning of the Facility.
"Electricity Department" means the local service provider supplying electrical energy for Operation Services of the Car Parking Facility;
"GVSCCL" means Greater Visakhapatnam Smart City Corporation Limited .
"Existing Assets" means those infrastructure components, plant, machinery, equipment and any other units existing at the Site of construction as on Commencement Date;
"FAS" means Fire Alarm Systems;
"FFS" means Fire Fighting Systems;
"FPS" means Fire Prevention Systems;
"Government Agencies" means all those agencies comprising of local, state and Central Government authorities directly or indirectly connected to provision of Car Parking Facility at Jagadamba, Visakhapatnam.
"HVACS" means Heating, Ventilation and Air Conditioning System.
"IFB" means Invitation for Bids;
"GVMC" means the Greater Visakhapatnam Municipal Corporation including all its successors, assignees;

"Major Maintenance" means large capital maintenance works requiring replacement of any part, component, machinery with their allied accessories and civil works constructed under this Contract.
"Mandatory Works" means those works which are listed in the Bill of Quantities and are required to be constructed, installed or erected as the case may be and commissioned in line with the provisions of this Contract unless such works may require change of scope or design as agreed by the Parties.
"Milestones" means the targets to be achieved during the concurrency of the Contract and at the end of the Contract Completion Period.
"Minor Maintenance" means routine preventive or corrective maintenance works such as minor repair, reconditioning, or replacement of spare parts to ensure serviceability of the created assets under this contract.
"Non-Performance Adjustment" means the adjustment in Payments made by the Employer from the Contractor Payment due to failure of the Contractor to perform as per contract stipulations to the satisfaction of the Engineer/Employer.
"Operation & Maintenance Service Period" is the period of contract commencing from the next date of Commissioning of the Facility and spreading over a period of 10 years.
"PCC" means Plain Cement Concrete
"Parking Charge" shall mean the charge per car parked in the created Facility for a specified time as decided by GVSCCL.
"Planned Maintenance" means activities required to undertake preventive maintenance of all assets created under the Contract;
"Project Management Consultant" means the agency appointed by the Employer to provide project management advisory services to the Employer.
"QA" means Quality Assurance;
"QC" means Quality Control;
"RCC" means Reinforced Cement Concrete
"RCCS" means Reinforced Cement Concrete Specifications;
"SEP" means Site Environmental Plan
"Schedules or Schedule" means the schedules forming part of this contract, or any one of them, as the context requires;
"Scope of Services" shall mean all those services to be provided by the Contractor in accordance to the obligations, activities, responsibilities and tasks in implementing the Project.
"Services" means all those activities, interventions, actions and tasks required as part of creating the Facility under this Contract including all planning, design, detailed engineering, procurement, construction, Operations, maintenance, and management in providing best possible car parking facility to the end users.
"TMP" means Traffic Management Plan;
"W/C Ratio" means Water / Cement Ratio

2. General Requirements

2.1 Site Description

The existing road network in City is already experiencing severe congestion due to on-street parking. There is very limited scope to widen the roads in adjacent built-up area. The existing on surface parking facilities in City area is insufficient for the present demand.

- **Available Parking area near Jagadamba = 367.89 Sqm**

In order to cater to the parking demand and decongest the Jagadamba area, a mechanized semi-automatic parking facility near Jagadamba is proposed under this contract package. The parking

capacity in the proposed near Jagadamba shall be 110 car spaces through semi-automatic puzzle parking of 6 parking levels above the Ground Floor.

2.2 Scope of Services

The Scope of Services under this Contract include all planning, survey, investigations, design, detailed engineering, supply, construction, Operation, maintenance and management activities required to Construct, Operate and Maintain the Mechanized Semi Automated Multi Level Car Parking Facility at the ear marked site near Jagadamba, Visakhapatnam.

The proposed site for this Car Parking Facility has area of about 367.89 Sqm. The parking capacity in the proposed near Jagadamba shall be 110 car spaces through semi-automatic puzzle parking of 6 parking levels above the Ground Floor.

Summary of Contractual Key Obligations

The key obligations of the Contractor under the Contract are summarized as follows: –

i. Topographical Survey of the Site area

ii. Geo-tech Investigation of the Site area.

iii. Planning & Design of the Civil Works, Plumbing Works, Drainage & Sewage Works, Road Works, Landscaping Works, Mechanical Works, Fire Protection & Fire Fighting Systems, Car Parking System Works, Electrical Works, HVAC System, Car Parking Management System and Instrumentation Works, for Parking Facility as per Employer's Requirement.

iv. Providing and Constructing all the required Civil Works, Plumbing Works, Drainage & Sewage Works Road Works, Landscaping works.

v. Supply & Installation of all the required Mechanical Works, Fire Protection & Fire Fighting Systems, Electrical Works, Instrumentation Works, HVAC System, Car Parking System and Car Parking Management System

vi. Operation & Maintenance of whole Facility for Ten (10) years after the date of commissioning including the defect liability period of one year. However during defect liability period the cost of Operation (Operational manpower namely operators , watch and ward, traffic regulators, health and safety, fuel and lubricants for DG sets, or any other requirement to Operate the system 24x7 shall be borne by the contractor) The electricity and water supply charges shall be paid by the contractor during Operation and maintenance period.

vii. Training Program for GVSCCL/GVMC/Authorised agency from GVSCCL staff during last 6 months of O&M period.

2.3 Phasing of Contract

The total contract period is 132 calendar months which includes Phase I- Design and construction period of 12 months and Phase II - 120 months Operation and maintenance period including 24 months defect liability period .

i. Design and Construction Period of (12 months): It shall be counted from the Contract Commencement Date and will be spread over for 12 months or as extended by the Employer on mutual agreement. The Contractor shall submit all the design related documents, as specified under this Section, within 60 days from the Contract Commencement Date to allow the Engineer / Employer to undertake a thorough review of the documents and suggest amendments if any. The Employer and the Contractor shall sign off the approved documents within 75 days from the Commencement Date or by such date permitted by the Employer and under no circumstances should it be more than 100 days from the Commencement Date.

ii. Operation & Maintenance Service Period (120 months): This phase is spread over 10 years or 120 months including 24 months defect liability period, commencing from the date of issue of completion certificate. During defect liability period the cost of Operation (Operational manpower namely operators , watch and ward, traffic regulators, health and safety, fuel and lubricants for DG sets, or any other requirement to Operate the system 24x7 shall be borne by the contractor) The electricity and water supply charges shall be borne by the contractor during Operation and maintenance period.

2.4 Contract Key Dates

The following key dates govern the term of the Contract:

i. The Contract Commencement Date shall be the date on which the Contract Agreement is signed by the Parties;

ii. The Construction Completion Date or Date of Commissioning shall be the date on completion of 12 calendar months from the Contract Commencement Date;

iii. Defect liability period is 24 months from the date of issue of completion certificate.

iv. Operation and maintenance period starts from the date issue of completion certificate.

v. The Contract Completion Date shall be the final date on which the Contract expires.

3. Contractor to Inspect Site:

The Contractor should visit and examine the site of work and satisfy himself as to the nature of existing roads and other means of communication and other details pertaining to the work and local conditions and facilities for obtaining his own information on all matters affecting the execution of the work. No extra charge made in consequence if any misunderstanding or incorrect information on any of these points or on grounds of insufficient description will be allowed.

4. Costs for Mobilization and Temporary Works

No payment above the unit prices quoted shall be made to the Contractor for mobilization costs, i.e. for providing transportation, light, power, tools, and equipment, or for furnishing building and

maintaining construction plant, access roads, sanitary conveniences, disposal, work, water supply, fire protection, guards, trestles, telephone system and other temporary structures, plant and materials, or for medical attention or health protection, or for watchmen or guards, or for any other services, facilities, or materials necessary or required to execute the work in accordance with the provisions of the Contract as these shall be considered as having been included in the prices stipulated for the various items of the Bill of Quantities.

5. Contractor's Offices, Stores and Equipment

The Contractor shall make his own arrangements for renting or acquiring sufficient land for the erection of his offices and stores plus parking / maintenance area for vehicles and equipment to be used on the Works at his own expense. The contractor shall establish and maintain these utilities at his own cost and no additional payment shall be made.

The contractor shall establish a laboratory with equipments and all other facilities for carrying out tests at site.

6. Contractor's Water and Power Supply:

The Contractor shall make his own arrangements for a hygienically clean and potable water supply for labor and construction work during Construction Period.

The Contractor shall make his own arrangements at his own expense for the supply of electricity services either using a metered connection from local mains or by providing his own generating plant to meet the requirements during Construction Period.

7. Site Office for the Engineer

The Contractor will also provide a minimum 25 m2 area of air conditioned office space furnished with 2 desks, 10 chairs, filing cabinet, shelves, 1 computer with accessories, including washing and toilet facilities, within the vicinity of the sub-project stretch, for the use of the Engineer and supervisory staff. The daily cleaning and maintenance of Engineer's Site office shall be arranged by the Contractor at his own cost.

8. Vehicle for the Engineer

The Contractor shall provide 1 hard top, petrol / diesel driven light motor vehicle having cylinder capacity of minimum 1400 cc for the sole purpose of the Engineer during the Construction Period only. The vehicle must be not less than the grade of Bolero. The cost of providing the vehicle for the specified period, its Operation & maintenance, driver, fuel charges and all other statutory expenses for average running of not more than 1500 Km. per month shall be borne by the Contractor and shall not be paid extra.

9. Sign Board

The Contractor shall provide a sign board at the site of the Works of approved size and design which provides (i) the name of the Project and the source of its finance; (ii) the names and addresses of the Employer, the Contractor and the Consultant; (iii) the name and short description

of the Project, (iv) the amount of the Contract Price; and (v) the starting and completion dates. It shall be deemed to be part of contract and no extra payment shall be made for the same.

10. Other Contracts and Contractors

The Contractor must ascertain to his own satisfaction the scope of the sub – project and the nature of other contracts that have been or may be awarded by the Employer in the execution of the project to the end that the Contractor may perform the Contract in the light of such other contracts.

Nothing herein contained shall be interpreted as granting to the Contractor exclusive occupancy of the sites in the project area. The Contractor shall not cause any unnecessary hindrance or delay to any other contractor working in the project area. If the performance of any contract for the project is likely to be interfered with by the simultaneous execution of some other contract or contracts, the Employer shall decide which contractor may proceed.

The Employer shall not be responsible for any damages suffered or extra costs incurred by the Contractor resulting directly, or indirectly, from the award or performance or attempted performance of any other contracts or line departments related to the project, or caused by any decision or omission of the Employer respecting the order of precedence in the performance of the contracts awarded for completion of the project.

11. Transportation and Storage of Materials

Transportation of any material by the Contractor shall be by suitable vehicle which when loaded does not cause spillage and all loads shall be suitably secured. Any vehicle which does not comply with this requirement or local traffic regulation and law shall be removed from the Site. All heavy materials which are not permitted to transport by traffic and police department during day time shall be transported at night time with required permissions from local authorities. All materials when brought to site by the Contractor shall be stacked and stored in a manner suitable to protect against, spillage, damage, breakage, pilferage etc., and readily available for checking by the Engineer at any time. The Contractor shall arrange for watch and ward of the materials at all times in a suitable manner satisfactory to the Engineer, all at his own expense.

12. Documents and Drawings

a) For the purpose of bidding only, a few basic drawings of proposed Facility have been provided in this document.

b) However, the contractor will prepare the detailed design and drawings for execution at site. These designs and drawings shall be got approved from the Engineer/Employer before execution of work.

c) The Contractor shall assume all responsibilities for the making of estimates of the sizes, kinds and quantities of materials and equipment included in the work to be done under the Contract.

d) He shall not be allowed to take advantage of any errors or omissions, as full instructions will be furnished by the Engineer/Employer if any such errors or omissions be discovered.

13. Works Programme

The Contractor should note that the work should be executed and completed within the stipulated time frame. The Contractor will accordingly submit a comprehensive Period-wise works programme for approval of the Engineer/Employer within 07 days after Commencement date. The

works programme shall be in the form of the Bar Chart / PERT chart / Microsoft Project office along with S-curve.

To monitor the progress of work, weekly review meetings will be held with the Contractor.

14. Setting Out of the Works

The setting out of the works should avoid un-necessary disturbance or removal of plants and trees. Only the removal of plants and trees that is absolutely necessary for the construction of the works will be permitted following the approval of the competent authority.

The Contractor shall at his own expense establish working or construction lines and grades as required and shall furnish and maintain stakes and other such materials and give such assistance including qualified staff as may be required by the Employer for checking setting out lines and grade marks. The Contractor shall be solely responsible for the accuracy thereof.

The Contractor shall safeguard all points, stakes, grade marks and bench marks made or established for the work, bear the cost of re-establishing them if disturbed, and bear the entire expense of rectifying work improperly done due to not maintaining or protecting, or removing without authorization, such established points, stakes and marks.

Any work done beyond the lines, levels and limits shown on the drawings or not agreed by the Engineer shall not be paid for and the Contractor shall make good any extra excavation as directed by the Engineer, at his own expense.

15. Site Order Book

Site order Book shall be kept by the Contractor at the project site. Orders entered in this Book by the Engineer / Employer or their authorized representative shall be held to have been formally communicated to the contractor. The Engineer / Employer or their authorized representative shall sign each order as it is entered and will hand over the duplicate to the contractor or his agent, who shall sign the original in acknowledgment of having received the order.

16. Protection of Works and Public

The contractor shall exercise precautions at all times for the protection of labor employed and public life and property at and around the sites of work. The safety provisions of applicable laws, building and construction codes shall be observed. Machinery, equipment and all hazards shall be guarded or eliminated in accordance with safety provisions.

During the execution of the work, the contractor shall put up and maintain during the night time such barriers and lights as will effectively prevent accidents. The contractor shall provide suitable barricades, red light "Danger" or "Caution" signs and watchmen at all places where the work causes obstructions to the normal traffic or constitutes in any way a hazard to the public.

17. Environmental Protection

The contractor will ensure that all actions are taken to ensure that the local environment of the site is protected and that surface and groundwater, soil and air are kept free from pollution (including noise) due to the works being undertaken.

18. Protection of Environment & Natural Habitat

- **Site Environmental Plan (SEP)**

  The contractor shall carry out the work for fulfilling the requirement of environmental impact assessment and management plan as related to construction of work as per the EMP provided in the document.

  The Contractor shall prepare a detailed Site Environmental Plan (SEP) for the work site, base camp, etc., showing arrangements for disposal of sanitary and other waste, location of fuel, oil and lubricant depots, sheds for equipment, labour and housing facilities, etc., prior to the construction for approval of the Engineer.

- **Safety, Security and Protection of the Environment**

  The Contractor shall take all necessary precautions against pollution or interference with the supply or obstruction of the flow of, surface or underground water. These precautions shall include but not be limited to physical measures such as earth bunds of adequate capacity around fuel, oil and solvent storage tanks and stores, oil and grease traps in drainage systems from workshops, vehicle and plant washing facilities and service and fueling areas and kitchens, the establishment of sanitary solid and liquid waste disposal systems, the maintenance in effective condition of these measures, the establishment of emergency response procedures for pollution events, and dust suppression, all in accordance with normal good practice and to the satisfaction of the Engineer. Should any pollution arise from the Contractor's activities he shall clean up the affected area immediately at his own cost and to the satisfaction of the Engineer, and shall pay full compensation to the affected parties.

- **Protection of Trees and Vegetation**

  The Contractor shall ensure that no trees or shrubs are felled or harmed except for those required to be cleared for execution of the Works. No tree shall be removed without the prior approval of the Engineer and any competent authorities.

- **Use of Wood as Fuel**

  The Contractor shall not use wood as a fuel for the execution of any part of the Works, including but not limited to the heating of bitumen and bitumen mixtures and the manufacture of bricks for use in the Works, and to the extent practicable shall ensure that fuels other than wood are used for cooking, and water heating in all his camps and living accommodations.

- **Water Supply**

  The Contractor shall make his own arrangements at his own expense for water supply for construction and other purposes. Only clean water free from deleterious materials and of appropriate quality for its intended use shall be used. In providing water the Contractor shall ensure that the rights of and supply to existing users are not affected either in quality, quantity or timing. In the event of a dispute over the effect of the Contractor's arrangements on the water supply of others, the Engineer shall be informed immediately and shall instruct the Contractor as to appropriate remedial actions to be undertaken at the Contractor's expense.

- **Power Supply**

  The Contractor shall make his own arrangements at his own expense for power supply for construction and other purposes. Only power from authorized connections or from well Operational

generator sets shall be used. In case of work in night shifts the Engineer shall be informed well in advance and all arrangements should be get approved by the Engineer in charge.

- **Relations with Local Communities and Authorities**

  In sitting and Operating his plant and facilities and in executing the Works the Contractor shall at all time bear in mind and to the extent practicable minimize the impact of his activities on existing communities. Where communities are likely to be affected by major activities such as road widening or the establishment of a camp, large borrow pit or haul road, he shall liaise closely with the concerned communities and their representatives and if so directed, shall attend meetings arranged by the Engineer or Employer to resolve issues and minimize impacts on local communities.

- **Fire Prevention**

  The Contractor shall take all precautions necessary ensure that no vegetation along the line of the road outside the area of the permanent works is affected by fires arising from the execution of the Works. The Contractor shall obtain and follow any instructions of the competent authorities with respect to fire hazard when working in the vicinity of gas installations. Should a fire occur in the natural vegetation or plantations adjacent to the road for any reason the Contractor shall immediately suppress it. In the event of any other fire emergency in the vicinity of the Works the Contractor shall render assistance to the civil authorities to the best of his ability. Areas of forest, scrub or plantation damaged by fire considered by the Engineer to have been initiated by the Contractor's staff or labor shall be replanted and otherwise restored to the satisfaction of the Engineer at the Contractor's expense.

19. Protection of Utilities

The Contractor is required to carefully examine the location of the Works and their alignments and to make special enquiries with all authorities or service suppliers concerning all utility lines such as water supply, sewers, gas pipe, telephone (underground and/or overhead) lines, electric cable (underground and/or overhead), cable TV lines, etc.; and to determine and verify to his own satisfaction the character, sizes, position and lengths of such utilities from authentic records. The Contractor shall be wholly responsible for the protection and/or facilitating relocation of such utilities as may be required, and shall not make any claim for extra work that may be required to protect or facilitate relocating such utilities or services. If any major shifting or realignment of water supply, sewers, drains, electric and telephone lines are necessary due to their interference with the proposed Works, the same will be arranged through the line agencies. The cost of such relocations will be paid by the Contractor which will be reimbursed under the Provisional Sum provided in the Contract, following approval by the Engineer.

20. Maintaining Utility Services

- The Contractor may be required to carry out the removal or shifting of certain services/utilities on specific orders from the Engineer for which payment shall be made to him. Such works shall be taken up by the Contractor only after obtaining clearance from the Engineer and ensuring adequate safety measures.
- No clearance or alterations to the utility shall be carried out unless specially ordered by the Engineer.

- Any services affected by the Works must be temporarily supported by the Contractor who must also take all measures reasonably required by the various bodies to protect their services and property during the progress of the Works.
- The Contractor may be required to carry out certain Works for and on behalf of the various bodies and he shall also provide, with the prior approval of the Engineer, such assistance to the various bodies as may be authorized by the Engineer.
- The work of temporarily supporting and protecting the public utility services during execution of the Works shall be deemed to be part of the Contract and no extra payment shall be made for the same.
- Adequate arrangements shall be made by Contractor to protect and support other services during all phases of the work. If the Contractor fails to protect the other services/utilities and any damage occurs to any services/material, Contractor shall reinstate such utilities to existing conditions at his own cost or pay for the rectification of damages so caused.

21. Arrangement for Traffic during Construction

The Contractor shall at all time carry out work in a manner creating least interference to the flow of traffic while consistent with the satisfactory execution of the same. The Contractor shall, in accordance with the directions of the Engineer, provide and maintain, during execution of the work, a passage for traffic either along a part of the existing carriageway, or along a temporary diversion. The cost of temporary diversion shall be deemed to be included in the quoted rates. The Contractor shall take prior approval of the Engineer regarding traffic arrangements during construction.

On road sides, suitable regulatory/warning signs as approved by the Engineer shall be installed for the guidance of road users. The signs shall be of approved design and of reflectors type, if so directed by the Engineer.

22. Cooperation at Site

Construction may be carried out in areas of restricted circulation. The Contractor's attention is particularly drawn to;

The need to maintain existing services and reasonable access for local residents and traders during the construction period; and

The probable presence of other contractors on site is to be coordinated by the main Contractor.

Heavy Materials shall preferably be transported to site during night time with necessary permissions from all concerned authorities.

All works shall be carried out in such a way as to allow access and afford all reasonable facilities for any other contractor and his workmen and for workmen of the Employer and any other person who may be employed in the execution and / or Operation at or near the site of any work in connection with the Contract or otherwise.

In the preparation of his program of work, the Contractor shall at all times take full account of and co – Operate with the programming of the work of other contractors so as to cause the minimum interference to them and to the public.

23. Access to Abutting Properties

For the duration of the Works the Contractor shall at all times provide convenient access to paths, steps, bridges or drives for all entrances to properties abutting the site and maintain them clear, tidy, and free from mud and objectionable matter.

In addition to the above, in order to ensure uninterrupted traffic flow, the Contractor has to provide and maintain suitable arrangement for the existing traffic to move across the construction work during the entire period of construction or till such time that alternative arrangements for the traffic are made.

24. Access for Inspection:

The Contractor shall provide at all times during the progress of the works and the maintenance period, proper facilities and necessary attendance for inspection or measurement of the work by the Engineer / Employer or their representatives.

25. Use of Equipment on Works

The following conditions regarding use of equipment on works shall be followed:

1. The Contractor shall be required to give a trial run of the equipment(s) to be deployed at site or establishing their capability to achieve the required Specifications and tolerance to the satisfaction of the Engineer before commencement of the work.

2. All equipment(s) provided shall be of proven efficiency and shall be Operated and maintained at all times in a manner acceptable to the Engineer.

3. No equipment or personnel will be removed from the site without permission of Engineer.

26. Surveying and measuring equipment

Equipment for surveying and measurement of the work shall be procured by the Contractor for his use at the Site. The same shall also be made available to the Engineer at site for any work connected with the Contract without any additional charge.

27. Site Photographs and Videos

The contractor shall arrange to take color photographs and videos at locations of the works to demonstrate conditions of the site before work commences / progresses during the construction period and after completion of the works. The photographs / videos may be required as evidence in defense of claims against the contractor for damage to buildings and property due to the execution of the works. Contractor will take all necessary work photographs and videos as per directions of Engineer. All site photographs and videos shall be submitted to the Engineer in three sets each which will become property of the Employer.

Nothing extra shall be paid to the Contractor on account of above requirements.

28. Record Drawings

The contractor shall prepare reproducible drawings of the whole works "as built". The drawings shall be produced to a standard similar to that of the Approved Drawings for execution.

Record drawings shall be prepared to the Engineer's approval as the work proceeds and shall be handed over to the Engineer as and when asked for. The completion drawing for individual

component of works shall be updated periodically during the contract period as the work progresses.

On completion of work, Contractor shall submit to the Engineer Six sets along with soft copies in three C.Ds of as built drawings indicating all works with complete information as may be required for reference. The Record Drawings shall then become the property of the Employer.

The cost of all above shall be borne by the Contractor and nothing extra shall be paid on this account.

29. Periodic Reports

The Contractor shall prepare and submit periodic reports on different plans, progress of Works, etc., The Contractor shall develop the required formats for the periodic reports and also identify any critical reporting requirements in order to enable timely decision making by the Engineer/Employer.

30. Final Clearance of the Site

On completion of work, wherever applicable, the contractor shall clear away and remove from the site all constructional plant, surplus materials, rubbish, scaffolding and temporary works of every kind and leave the whole of the site and works in a clean condition. Final contract payment shall be withheld until this has been done, to the satisfaction of the Engineer.

31. Technical Requirements

31.1 Specification Standards and Codes

Wherever reference is made in the Contract to specific standards and codes to be met by the goods and materials to be furnished, and work performed or tested, the provisions of the latest current edition or revision of the relevant standards and codes in effect shall apply, unless otherwise stated in the Contract. Where such standards and codes are national or related to a particular country or region other authoritative standards which ensure an equal or higher quality than the standards and codes specified will be acceptable subject to the Engineer's prior review and written approval. Differences between the standards specified and the proposed alternative standards must be fully described in writing by the Contractor and submitted to the Engineer at least 28 days prior to the date when the Contractor desires the Engineer's approval. In the event the Engineer determines that such proposed deviations do not ensure equal or higher quality, the Contractor shall comply with the standards specified in the Bid Document.

The design criteria like loading standards, permissible stresses and quality standards, to be followed for the preparation of design and drawings will be as per the latest standards, codes and recommendations of the Indian Bureau of Standards. The design shall not only satisfy the functional requirements but also consider the service condition and provision is to be made for future expansion.

In case of absence of suitable IS specifications and code of practices, reference may be made to other recognized international standards and codes such as International Standards' Organization

(ISO), Euro Norm (EN), British Standards Institution (BSI), ASTM or AASHTO, Deutsche Industries Norm (DIN), ANSI, AFNOR or equivalent standards. Where even these are silent, the construction and completion of the works shall conform to sound Engineering practice as approved by the Engineer and in case of any dispute arising out of the interpretation of the above, the decision of the Engineer shall be final and binding on the Contractor

31.2 Samples and Tests during Construction

For ensuring the requisite quality of construction, the Materials and Works shall be subject to the quality control tests as per IS codes as applicable. The testing frequencies set forth are desirable minimum and the Engineer shall have full authority to get the additional tests carried out by the Contractor as frequently as he may deem necessary, to satisfy himself that the Materials and Works comply with the appropriate Specifications.

The materials to be incorporated in the permanent works shall be subjected to Third Party Inspection as decided / directed by the Engineer, the cost of which will be reimbursed to the Contractor out of the Provisional Sum of the Contract.

Where no specific testing procedure is mentioned, the tests shall be carried out as per the prevalent accepted Engineering practice to the satisfaction of the Engineer.

The Contractor shall be responsible to develop a quality control program and to provide all necessary materials, apparatus, instruments, equipment, facilities and qualified staff for sampling, testing and quality control of the materials and the works under the Contract. Without limiting the generality of the foregoing, the Contractor shall establish either (i) establish a testing laboratory at the site of Works which is adequately equipped and staffed to carry out all sampling and testing in accordance with the requirement set out in the General Specifications and / or these Specifications and provide all field equipment and apparatus as necessary to conduct all specified in-situ tests and / or any Tests on Completion, or (ii) arrange for routine sampling, testing and reporting, as required, through a certified independent testing laboratory acceptable to the Engineer. The Engineer may also direct the Contractor to arrange additional independent sampling and laboratory testing under the supervision of the Engineer, the cost of which shall be borne by the contractor. The Contractor shall furnish certified copies of all test reports to the Engineer within 3 days of completion of the specified tests.

The Contractor shall, within 14 days after the Site taking over date, submit to the Engineer for his consent, a detailed description of the arrangements for conducting the quality control program during execution of the Works, including details of his testing laboratory, equipment, staff and general procedures. If following submission, or at any time during the progress of Works, it appears to the Engineer that the Contractor's quality control program is not adequate to ensure the quality of the Works, the Contractor shall produce a revised program which will be adequate to ensure satisfactory quality control.

31.3 Workmanship

All workmanship shall be in conformance with the best trade practices. Particular attention shall be given to the appearance of exposed work without compromising on the Quality Standards.

All defective works shall 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/rectification etc. as specified by the Engineer, the cost of repairs/rectification shall be borne by the Contractor.
Contractor shall depute competent Engineers for supervision of works from his end and ensure that the quality of work is carried out as per the specifications and quality standards specified in the tender.

31.4 Approval of Materials

Approval of all sources of material for Works shall be obtained in writing from the Engineer before their use on the project.
Quality assurance plan shall be submitted before the dispatch of the material from the works for the approval of the Engineer.
Samples of cement, sand, aggregate, bricks, steel, and any other material to be used in permanent works of the contract shall be submitted for the approval of the Engineer.

31.5 Quality Control on Works and Materials

i. The Contractor shall be responsible for the quality of the work for all the works carried out by him for this contract. He shall, therefore, have his own independent and adequate set-up for ensuring the same.

ii. The Engineer shall inspect the work from time to time during and after construction and ascertain the quality of the work after testing (by himself, by his Testing and Quality Control Units or by any other agency deemed fit by him). All the procedures and tests as directed by the Engineer shall be followed.

iii. The Contractor shall provide necessary cooperation and assistance in conducting the tests and obtaining the samples for tests and carrying out the field tests as required by the Engineer from time to time. This may include provision of labor, attendance, assistance in packing and dispatching and any other assistance considered necessary in connection with the tests.

iv. The Contractor shall carry out modification in procedure of work, if any, as directed by the Engineer during inspection.

v. Works falling short of quality as per test standards shall be rectified by the Contractor as directed by the Engineer at his own cost.

vi. Where the Engineer considers that in the interest of the control of the quality on materials or workmanship, modifications, if any, are necessary, such modifications shall be carried out by the Contractor at no extra cost.

vii. The Contract rate quoted for various items of work in the Bill of Quantities shall be deemed to be inclusive of all costs of the provisions indicated in the above mentioned clauses.

31.6 Quality Assurance and Quality Control

The contractor shall execute all the works and perform tests as per QA & QC Manual, as approved by the Engineer / Employer.

31.6.1 General responsibilities

Contractor shall be responsible for providing:

- All necessary plant, labor, equipment and construction materials to be used in the works;
- All plant, equipment, materials and labor for temporary and auxiliary works;
- All equipment and components to be installed or incorporated in the works;
- Transportation and storage facilities for all materials and equipment.
- Office and accommodation for staff and labor; and for consultants and client's staff
- Sanitation facilities at the site; and
- All necessary staff and equipment for testing and quality control including site office laboratories.

Contractor shall also be responsible for executing and completing the works in accordance with the specified standards and specifications, within the contractual time allowed, and within the agreed price for these works. The contractor shall be responsible for preparing detail design/drawings/documents and obtaining their approval.

31.6.2 Quality Assurance/Quality Control Duties

The contractor's QA/QC duties are summarized below in the Table. Other duties shall be performed as stipulated in the contract documents or directed by the Engineer/Employer.

Table for List of Contractor's QA/QC Duties

Activity / Item	Contractor's QA/QC Duties
Designs & Drawings	• Maintain design register at site • Use only approved drawings for construction
Test laboratory and equipment	• Intimate PMC/PIU the details, date of completion with requisite manufacturers' and calibration certificates • Maintain the equipment in good condition and calibrate as necessary
Material receipts	• Enter receipts in material register • Intimate PMC/PIU in writing
Materials testing	• Prepare mix designs as required by contract and submit test results to PMC/PIU • Take test samples in presence of PMC/PIU when requested • Perform materials tests • Submit test reports to PIU and PMC with monthly reports • Maintain test log
Rejected materials	• Enter in material register at site • Intimate PIU and PMC in writing the proposed date of removal from site and confirm after removal
Material consumption	• Enter daily consumption of materials in material register and indicate balance quantity
Construction equipment	• Intimate PIU and PMC the details, date of mobilization along with requisite insurance certificate

Activity / Item	Contractor's QA/QC Duties
	• Maintain equipment in good working condition
Construction	Intimate PIU and PMC in writing when construction is going to commence and what activities are proposed to be undertaken. Intimate PIU and PMC in advance when critical works, such as concreting, embankment, paving, pipeline laying and jointing, testing, etc., would be undertaken, along with the test certificates of the materials proposed to be used in these works. No critical activity shall start unless the material test certificates are verified and approved by the Engineer. Provide necessary QA/QC manuals.
Daily work progress	Maintain in daily log
Testing of works in progress	Perform tests as per contract requirements Submit test reports to PIU and PMC Maintain test log
Rejected work items	• Intimate PIU and PMC in writing the proposed date of removal from site and confirm after removal, or (if so agreed by PIU and PMC) • Rectify defective work and invite PIU and PMC for re-inspection.
Instructions from Engineer	• Enter change orders, site instructions, letters and minutes of meetings issued by the Engineer and Consultants in the Instruction Log
Inspection of Engineer	• Take instructions in Site Order Book. • Advise PIU and PMC of compliance
Progress scheduling and control	• Prepare and maintain project schedules and undertake work in accordance with approved schedule
Reporting	• Prepare and submit Monthly Progress Reports
Records	Maintain the following records on site: • Material Register • Site Order Book • Hindrance Register • Daily Log • Design Register • Test Log • Instruction Log • Equipment Register • Labor Register • Approved Construction Drawings • Test Reports • Site Laboratory Record • Permissions Issued by Departments • Correspondence Record • Copies of Monthly Progress Reports • Any other records as specified in the Contract and/or as instructed by the Engineer

32. Detailed Scope of Services

32.1 Design Period

Design Period shall be reckoned from Date of Contract Commencement. During this period, the Contractor shall prepare a holistic and comprehensive Parking Plan, minimum of specified capacity, for providing the latest Parking Facility to the users. The Contractor will also get the Topographical Survey & Geo-tech investigation done during this period. Accordingly the Contractor will prepare the Planning and Design of all the components of the Car Parking Facility for required Car Parking Spaces. All the designs and drawings shall be submitted to the Engineer / Employer for approval. The Contractor will incorporate all the necessary corrections in his Planning, design and drawings in compliance to the observations made by the Engineer / Employer and it will remain the responsibility of the Contractor to obtain the necessary approval of the Planning, design and drawings, submitted by him, from the Engineer / Employer / Competent Authority within this Preparatory Period.

The Contractor will submit, within seven days of start of this period, a separate comprehensive work schedule for this period reflecting the planned dates / time for submission of various documents of each component of Facility, Time required for the Engineer / Employer to check and verify the documents, Time required to incorporate the observations of the Engineer / Employer, Date / Time of Re-submission of corrected documents, Date/Time of approval from the Engineer/Employer/Competent Authority.

The fee, if any, for approval of drawings by Competent Authority shall be reimbursed to the Contractor out of the Provisional Sum of the Contract.

32.1.1 General

a) The Contractor shall establish contact with all relevant stakeholders, including the designated consultants under Greater Visakhapatnam Smart City Corporation limited, Visakhapatnam and become familiar with the place, site and type of the work required for creating the Mechanized Semi-Automatic Multi Level Car Parking Facility. The Contractor shall also be in know-how of the applicable standards and guidelines for providing Semi Automated Car Parking Facility.

b) The Contractor shall satisfy himself about the nature and scope of work and the prevailing site conditions.

c) In order to undertake studies and construction activities under this Contract, the Contractor shall keep liaison with Greater Visakhapatnam Smart City Corporation limited, (GVSCCL), Greater Visakhapatnam Municipal Corporation (GVMC), Traffic Police Department and other government agencies regarding governing Laws and regulations such as:

   i. Environmental and social impact assessments and prevention, mitigation and monitoring of impacts during construction;
   ii. Compensation for damages to nearby properties;
   iii. Occupational health and safety including workers' compensation;
   iv. Prevailing Labor Laws and
   v. Building / Construction Bye-laws
   vi. Signage for construction works.

32.1.2 Preparatory Surveys

a) The Contractor shall undertake a detailed topographical survey covering the entire Site Area. The survey data shall depict all the physical features like adjoining structures, roads, drains, existing utilities and other relevant features which would influence the constructional activities of the Facility.

b) The Survey Plan drawing and Contour Plan of the site at 0.25 m interval shall be prepared and submitted to the Engineer/Employer in three sets of hard copies along with the soft copy. The Survey levels should be taken with reference to GTS Bench Mark.

c) The Contractor shall fix 2 No. Temporary Bench Marks at selected locations on the site with their levels encrypted. The Contractor shall be responsible for keeping these TBMs undisturbed till the completion of defects liability period.

d) The Contractor shall carry out geo-tech investigation by conducting 2 Nos. Plate Load Tests of Super Bazaar Parking area site at the required depth as per IS specifications.

e) The findings of geo-tech investigation shall be submitted to the Engineer of the Contractor in the form of a complete report along with the recommendation for adopting SBC of the soil. The submission shall be in three sets of hard copies along with a soft copy.

32.1.3 Documents to be submitted by the Contractor for approval:

The following documents are required to be submitted by the Contractor for approval of the Engineer / Employer:

Part I – Baseline Reports:

a) The Topographical survey data.

b) The Geo-tech investigation report.

Part II – Constructional Plan:

a. Planning of Multi-level Semi - Automated Car Parking System for the required No. of Car Parking

b. Detailed designs, drawings and cost estimates of all the components of the Facility including the proposed Car Parking Management Systems.

c. Plan for Construction of the Office Building for the contractor, store room and detailed plan of installing various components of the semi-automatic multi-level parking systems in the said building.

d. Layout Plan and area allocation for each facility such as:
   i. Layout and Flow Diagram for Cars
   ii. Architectural design
   iii. Building Structure
   iv. Structural drawings
   v. Entry and Exit Area for Parking Structure
   vi. Pedestrian paths and landscaping areas as applicable to the project
   vii. Public convenience facilities

viii. Other facilities

e. Methodology and timelines for implementation;
f. Contractor Personnel deployment plan;
g. Item-wise individual cost breakup of all BOQ items for the purposes of payment only.
h. Investments required for the Complete Development of the Facility.
i. Cash-flow plan during the contract periods; and
j. Detailed methodology for continuous monitoring of the performance of the Contractor in achieving and maintaining the Performance Standards for release of the eligible Payments.

Part III – Operating and Management Procedures and Policies:

a. Annual Operating Plan (AOP) covering all Operations, maintenance and management requirements with watch & ward;
b. Operation and Maintenance Manuals.
c. Emergency Response Plan (ERP);
d. Customer Management and Public Relations Plan;
e. Standard Operating Procedures (SOPs) for routine Operations and emergency responses;
f. Energy and space optimization program;
g. Detailing of an Integrated Management Information System (IMIS) including its architecture, data capture, management and reporting structures, protocols including all related hardware, software, installation, and Operation and maintenance requirements; and
h. Periodic reporting plan including the formats for different performance reports.

IMP.: The Contractor shall submit the above documents, at the maximum, within 60 days from the Contract Commencement Date to allow the Engineer / Employer to undertake a thorough review of the documents and suggest amendments if any. The Employer and the Contractor shall sign off the approved documents within 75 days from the Commencement Date or by such date permitted by the Employer and under no circumstances should it be more than 100 days from the Commencement Date.

32.2 Construction Period

a) The Scope of Services during the Construction Period shall essentially comprise of implementing the procurement, supply, construction, and installation activities of all the components of the Facility as per approved design and drawings.

b) The implementation of these activities shall be in accordance to international best practice and industry standards and sufficient care shall be taken by the Contractor in minimizing supply interruptions, traffic disruptions and ensuring good and timely communications with the Engineer/Employer. All the Works and interventions proposed in the approved design and drawings shall be in conformity with the Specifications as set out in the Employer's Requirements. The components relating to this Construction period essentially comprise of but are not limited to the following mandatory works.

Mandatory Works:

The Contractor shall Supply, Construct or install the Mandatory Works as detailed hereunder, which are included in the Bill of Quantities (BOQ) for the purposes of pricing only. The Works as per the BOQ essentially constitute of the following:

a. Construction of the Parking Facility as per detailed surveys, planning, design and drawings.
b. Construction of Sanitary & Plumbing Works,
c. Construction of Drainage & Sewage Works,
d. Construction of Road Works,
e. Construction of Landscaping Works,
f. Supply and Installation of Mechanical works
g. Supply & Installation of Fire Protection & Fire Fighting Systems
h. Supply & Installation of Car Parking Systems,
i. Supply & Installation of Electrical works
j. Supply and Installation of HVAC System, Supply and Installation of Instrumentation Works,
k. Supply and Installation of Car Parking Management System
l. Commissioning of created Car Parking Facility

The Works proposed in the BOQ as summarized above are indicative only. The Contractor shall investigate, conduct various surveys, and shall design and propose the actual Works to be implemented / constructed. Any deviations and cost implications due to changes in the proposed Works when compared to the Works included in the BOQs should be explicitly included in the documents submitted by the Contractor for approval with adequate justification.
The Contractor shall take over the proposed site in an "as is" condition on the date as specified in the Contract Data and implement the Works in accordance with the approved design and drawings. Based on a preliminary Surveys, certain lists of Works have been included as part of the Section 7 – Employer's Requirements under Mandatory Works.
These works have been envisaged for constructing the Car Parking Facility for 90 car spaces through 5 level semi automatic puzzle parking. The Contractor may suggest measures for the improvement, if any.

32.3 Operation and Maintenance Period:

32.3.1 Integrated Management Information System

A month before the commissioning of the created facility, the Contractor, shall develop, establish, Operate and manage during the remaining Contract Period a comprehensive integrated management information system (IMIS) in respect of all matters including but not limited to:

a. The billings and collection systems for the collection of revenue on hourly / 24 hours / monthly / half yearly / yearly basis for parking of cars as well as two wheelers;
b. Services for users, including data bases relating to complaints and questions, response times and resolution;
c. Financial management, including accounting systems;
d. Performance information systems; and
e. Asset registers from the perspective of maintaining a computerized maintenance management system (CMMS) linked to financial and inventory systems.

32.3.2 Billing and Collection Systems

The billing and revenue collection shall be managed by the contractor during the entire contract period.

32.3.3 Operation and Maintenance Obligations

The contractor has to operate and maintain the constructed facility for the entire contract period. The cost of Operation & Maintenance during this period shall be borne by the contractor through the revenue generated from the parking facility and advertising. Year on year rates for parking and advertising shall be approved by the authority.

32.3.4 Training

The Contractor shall plan and develop the course content, and implement on-the-job and classroom based training, for GVSCCL/GVMC deputed staff of at least 15 personnel in 3 batches of 5 personnel each, during first 6 months of the Operation & Maintenance period. The Contractor shall organize training for identified managers from amongst the GVSCCL/GVMC deputed staff in technical aspects of semi automatic car parking systems to enable GVSCCL/GVMC to build sufficient capacity and skills to manage the said car parking systems at a later date if required.

Annexure – A : Scope of Works for Civil and Steel Components including Sanitary & Plumbing works, Drainage & Sewage Works, Rain Water Harvesting System, Road Works and Landscaping

General

Based on surveys and investigations conducted by the Contractor, the Contractor will plan and frame a comprehensive proposal for providing the desired Car Parking Facility.

The broader scope of civil work will be as offered by the Contractor including the modification and additions accepted. However, a brief description of scope for civil works along with few fixed parameters is detailed here under:

(a) Car Parking Systems and General Works :

1) The Semi Automatic Puzzle Car Parking Building will be constructed near the Jagadamba junction area and will house 110 car parking spaces through 7 levels including ground level.

2) The Puzzle Parking System will have a maximum height of 15 meters above finished ground floor level.

3) One row of the Ground Floor of the Parking facility shall be utilised for getting the cars parked in the system remaining area of the ground floor shall be utilised for entry, exit, and vehicle movements and to accommodate other utilities. However, all the Service Rooms, Control Rooms, Waiting Rooms, Collection Booths and other related facilities shall be provided at the Ground Floor level.

4) Ground and next two levels shall be proposed to accommodate SUVs / cars with carriers.

5) Proper space must be kept aside on the ground floor for Car Parking Management Systems, DG Sets and other services.

6) Server Rooms and Control Rooms of appropriate size along with approved finishing as per specifications shall be provided at ground floor level of the Premises.

7) Service Stair cases of adequate size along with approved finishing, for Maintenance & Service purpose shall be provided in the one and only level below the ground where puzzle parking systems are to be incorporated.

8) False ceiling of approved design shall be provided in Waiting Area and Control Rooms by the Contractor.

(b) Other Civil Works

1) Collection / Dispensing / Security Booths of appropriate size, properly finished as per directions of the Engineer / Employer shall be constructed at each Exit / Entry as per approved plan and shall be furnished with standard approved furniture along with boom barriers. These booths shall be constructed as load bearing brick masonry structures with RCC slab.

2) Construction of all approach Roads including Footpaths within the complex from the adjoining Main Roads along with necessary traffic signs, markings & other road appurtenances shall be in the scope of the Contract.

3) The Contractor has to design and provide the Rain Water Harvesting System i.e. its collection and utilization of the collected water in Toilets, Landscaping and washing.

4) It will be in the scope of the Contract to provide a 50 mm dia. G.I. Pipe connection from water main pipe of PHE department up to sump tanks at the Ground Floor. A provision of 100 mm dia. G.I. pipe from main road up to sump tanks for the purpose of filling the Sump Tanks by Water Tankers shall also be kept. All pipes are to be laid underground. The G.I. pipes shall be of 'B' Class.

5) Contractor shall insert, at no extra cost, all the necessary sleeves fabricated out of G.I. 'B' class pipe or as instructed, in all the beams, at the time of casting of the slab and beams of the toilet areas. Also

all the sleeves required for the underground and Over Head Tanks shall be provided by the Contractor at no extra cost.

6) The Contractor shall provide all inlets, outlets, washouts, vents, overflow and all such other piping connections for Water Storage Tanks.

7) All Sanitary, Plumbing, Drainage & Sewage works required for successful completion of the sub-project shall be in the scope of the Contractor.

8) The Contractor will have to obtain necessary sewerage / drainage approvals, layout scheme approval, water connection, etc. & all other approvals and compliances from various statutory departments as required and no extra amount would be paid for the same except reimbursement against G.R. of actual Govt. Fee for the said approvals.

9) The Contractor shall construct a platform for the Electrical sub-station (Transformer) including its enclosure by way of chain-link fencing.

Annexure – B : Scope of Works for Mechanical Components, Car Parking System and Fire Fighting System

Scope of Mechanical Works:

a) The Contractor has to provide two boosting pumps (one stand by and one working) of required capacity with suitable piping and fitting for overhead water tank at the top of the puzzle parking systems on a civil structure in the corner and provide two separate pumps of required capacity (one stand by and one working) for Fire Fighting Operations with a separate plumbing system in the sump tank of required capacity at ground floor along with pumps of required capacity. Any additional pumps, if required, for efficient functioning of the system as a whole shall also be provided by the Contractor at no extra cost.

b) All necessary valves and fittings for efficient pumping system are to be provided by the Contractor.

c) The Contractor shall test the respective system as described to establish whether the installation has been carried out to facilitate efficient Operation.

Scope of Car Parking System:

a) Based on surveys and investigations conducted by the Contractor, the Contractor will Plan a comprehensive proposal for providing the Car Parking Facility for 110 car spaces through 6 level structure of puzzle parking systems

b) Provision for disabled persons' car parking spaces has to be provided at ground floor.

Scope of Fire Fighting System:

1. The scope of work covers Fire Fighting (Combination of Wet Riser & Sprinkler System) for Proposed Car Parking Facility. It shall be the Contractor's responsibility to plan, design and provide complete Fire Fighting System as per the applicable codes.

2. The Contractor should provide all fire related pumps like fire sprinkler pump, Smoke detector, fire extinguishers, fire hydrant, fire address system, fire prevention, fire alarm system etc.

3. Fire Detection & Fire Fighting systems are to be provided by the Contractor at each level of the car parking facility or at the top level only of the puzzle parking system as prescribed by the CFO.

4. The Fire Alarm system planned for this project must in general cover the Design, Quality Control of all The Detectors / Call Points / Annunciation system hooked up to main panel.

5. The Fire Protection System must consist of external & internal Hydrant system as required for different areas within all the levels of car parking system as prescribed by the CFO.

6. Foam Cylinders must be provided at the ground level of puzzle parking systems to extinguish fire caused due to any kind of fuel.

7. The Contractor shall set out the drainage, soil, waste and water pipe lines and other fittings and fixtures in accordance with the approved plans and designs.

8. The Contractor should note that this work should be executed and completed before the completion of the general work and the Contractor shall take care to see that no damage or breakage is done to work once it is constructed and finished. The sanitary and water supply work

shall be programmed in such a way that it does not hold up the general construction or works of other trades.

9. Contractor shall prepare Site drawings indicating the layout, Specification of pipes fittings and all other information required for execution of work. The Shop drawings shall be got approved before carrying out any section of work. The Shop drawings shall be submitted 7 days in advance for approval from the Engineer / Employer.

10. On completion of work, Contractor shall submit to the Engineer 6 copies of as built drawings indicating all works with complete information as regards to sizes, Operational valves, chambers etc. including levels and other such information as may be required for reference.

11. Contractor shall ensure that all the sleeves required at the time of casting of water tank, over head tank and any other sleeves required for Plumbing purpose shall be provided as per the drawings.

12. Contractor has to submit his activity schedule in accordance with the civil activity bar chart (especially water proofing, tiling etc.) and ensure proper coordination with the various agencies to whom these specialized works have been assigned.

13. Contractor will have to obtain necessary approvals for the Fire Fighting works including all approvals and compliances from various statutory departments as required and no extra would be paid for the same except reimbursement against G.R. of actual Govt. Fee for the said approval.

14. If so directed, materials shall be tested in an approved testing laboratory and the Contractor shall produce the test certificate in original to the Engineer / Employer and the entire charges for original as well as repeated tests shall be borne by the Contractor.

15. For the purpose of testing of the Sprinkler system after its completion, the Contractor shall provide free of cost Sprinkler heads to be checked by the Engineer / Employer. The test shall be carried out on the sprinklers separately for each zone.

16. The Contractor shall provide all materials, tools, testing, materials, scaffolding, labor and electric power, necessary for the perfect completion of the whole work at his own cost.

17. The Contractor shall obtain from time to time various permissions and the completion certificates as per rules of all local and statutory authorities.

18. The Contractor shall be required at his own expense to test the installation with water.

19. The Contractor shall be responsible for any repairs or replacement of any defective Part and shall rectify the installation free of cost to the owner.

Annexure – C :Scope of Works for Electrical Components and HVAC (Heating, Ventilation and Air Conditioning System)

SCOPE OF ELECTRICALS WORKS:

1. GENERAL

Listed below are the Electrification works to be carried out by the Contractor for Internal and External areas of the Car Parking Area along with all necessary described systems and equipments as per technical specifications, drawings, scope of work and to complete the installation in all respects and make it ready to use and ultimately commission it to the satisfaction of the Engineer / Employer.

2. SCOPE OF WORK

1) The entire scope of work of the contractor for electrical works must be completed as per the scope mentioned in this document after thoroughly adhering to the specifications of the related electrical works mentioned separately in the Specifications' section.

2) The Transformer of adequate capacity would be provided by the electrical department of the State at appropriate place within the Site premises and from that location the power distribution should be allocated to the entire building by the contractor. The cost of Transformer shall be paid to the line department out of Provisional Sum.

3) The contractor must do a detail study and find out the exact electrical load requirements for this entire project and accordingly recommend to the Engineer / Employer, the details of the capacity of the Transformer required so that the same can be delivered by the concerned Line Department.

4) The contractor's scope of work with regard to electrical works will comprise of :-

   a) Supply, Installation, Testing & Commissioning of substation equipment such as 2 Nos. DG sets for working alternatively with Synchronous & AMF Panels, HT / LT Panels, Feeder Pillar, RMU etc.

   b) Cabling,

   c) Internal electrification,

   d) Lighting fixtures,

   e) Street lighting,

   f) Voice & Data system,

   g) CCTV system, Access control etc. with all its allied Electrical equipment

   h) The contractor should provide all applicable standards, codes, etc.

   i) Earthing system,

   j) Lightning arrestor, etc. with all allied equipments.

5) The Contractor shall carry out and complete the said work under this contract in every respect in conformity with the bid documents and with the directions of and to the satisfaction of the Engineer / Employer.

6) Unless stated elsewhere in these documents, all equipment like pipes, cables, transformers, generators, panels, poles, lighting fixtures etc. are to be factory tested either in this country or abroad by third parties & same shall be intimated to the Engineer / Employer in advance. All incidental expenses for the said third party inspection incurred for factory tests shall be borne by the contractor and later will be reimbursed by the client from the Provisional Sum.

7) The contractor shall furnish all labor, materials and equipment including transportation and other incidental activities necessary for supply, installation, testing and commissioning of the complete electrical system as described in the Specifications. This also includes any material, equipment, appliances and incidental work not specifically mentioned herein or in the Specifications section but which are necessary and customary to be performed for the successful completion of the project. The brief scope of electrical system to be provided by the contractor shall be as below but not limited to:

   a) Contractor shall carry out all necessary tests required to establish the guarantee performance as per IS codes.
   b) Contractor shall carry out testing and commissioning of the D.G. sets (2 Nos.) as per required capacity with AMF panel supplied by him.
   c) Contractor shall also carry out all necessary tests at site required to be sure of the performance of the items used in these Electrical Works, before installing the same.
   d) Contractor shall provide all necessary literature for erection and commissioning works to the Engineer / Employer.
   e) The detailed design arrangement of the equipment shall be the responsibility of the Contractor subject to the approval of the Engineer / Employer.
   f) All conduits should be concealed wherever applicable
   g) The Contractor shall provide the following:
      i) All the necessary junction boxes, outlet boxes Switches, plug sockets, cover plates wiring for lighting and power circuits and all other wiring accessories
      ii) LT Cables, Mains and Sub-Mains, Rising Mains / Bus Ducts, GI raceways and junction boxes, HT/LT panel, Main Distribution / Sub Distribution panels, Final Distribution panels & Capacitor Panels as per their required sizes & thickness (IS Standards) Cables on cable trays and / or within suspended ceiling spaces including installation, cable trays, hangers, supports, cable terminations and all fixing accessories.
      iii) Earthing (Grounding) System.
      iv) Lighting Protection System.
      v) Supply and installation of Lighting Fixtures for Street Lighting areas.
      vi) Installation of Internal Lighting fixtures.
      vii) HT switchgear as per required sizes.
      viii) Substation Earthing.
      ix) Supply and installation of HT Servo Voltage Stabilizers with by-pass arrangements.
      x) Supply and installation of conducting & cabling for Voice & Data Network.
      xi) Supply & Installation of separate cable system for fire detection, fire prevention / fighting and Ventilation equipments.

8) Both the DG sets provided as a back-up for this car parking system must be connected with the entire parking systems and must be equipped with automatic switch over mechanism.

9) The contractor shall carry out the work in accordance with the Specifications, and other documents specified in the bid documents. The contractor shall be fully responsible for the performance of all the equipments at the specified parameters in electrical works and for the efficiency of the installation to deliver the required end result.

10) The contractor shall guarantee that the Electrical system as installed shall perform to complete satisfaction of the Engineer / Employer. The contractor shall also guarantee that the performance of various equipments individually, shall not be less than the quoted capacity; also actual power consumption shall not exceed the quoted rating, during testing and commissioning, handing over and guarantee period.

11) After completion and successful commissioning of the Electrical works, it shall be responsibility of the Contractor to obtain the necessary NOC from concerned Line Department

12) At the close of the work and before issue of final certificate of virtual completion, the contractor shall furnish written performance guarantee against the replaced materials. The Contractor shall hold himself fully responsible for reinstallation or replacement, free of cost for the following:

    a) Any defective work or material supplied by the Contractor.

    b) Any material or equipment damaged or destroyed as a result of defective workmanship by the Contractor.

13) The work shall be carried out to the satisfaction of the Engineer / Employer and in accordance with the Specifications, Regulations of the Electrical Supply Authority, Indian Electricity Rules and Regulations and latest Indian Standards.

14) The Contractor shall ensure the sufficiency of the size of electrical shaft openings, clearances in wall and suspended ceilings for proper installation of his conduits, cables, cable trays, panels etc**.**

15) The Contractor shall locate all equipment which must be serviced, Operated or maintained in fully accessible positions. The exact location and size of all access panels, required for each concealed control damper, valve or other devices requiring attendance, shall be finalized with the Engineer within sufficient time. Failing this, the Contractor shall make all the necessary repairs and changes at his own expense.

16) All materials and equipments shall conform to the relevant Indian Standards and shall be of the approved make and design.

17) Makes shall be strictly in conformity with list of approved manufacturers as per IEC/IS Codes as mentioned in the makes list.

18) Where manufacturer has furnished specific instructions, relating to the material and equipment used in this project, and where nothing has been specifically mentioned in these documents, the manufacturer's instructions shall be followed in that case.

19) The contractor shall provide all necessary instruments and labor for testing, shall make adequate records of test procedures and readings, shall repeat any tests requested by the Engineer / Employer

20) Upon completion of the work and before issuance of certificate of virtual completion the contractor shall submit to the Engineer of the Client four sets of layout drawings in progressive manner for individual systems drawn at approved scale, indicating the complete wiring system as installed.

21) Drawings shall be prepared on AUTO-CAD (latest version). Along with the hard copies, the contractor shall submit copies of all drawings on a CD. These drawings must provide:

a) Substation equipment layout & all power distribution panel layout.
b) Single line power distribution diagram including control wiring for transformer & DG sets.
c) Cable Trays with number and size of cables installed
d) Run and size of conduits, junction and pull boxes.
e) Raceways and Junction Boxes.
f) Number and size of conductors in each conduit with phase identification
g) Location and rating of sockets and switches controlling the lighting and power outlets.
h) Location and details of distribution boards/panels, mains, switches along with phase balancing details
i) A complete wiring diagram as installed and single line diagrams showing all connections in the complete electrical system
j) Location of all earthing stations, route and size of all earthing conductors manhole
k) Layout and particulars of all HT & LT cables.
l) Instruction, maintenance and Operation manuals including maintenance schedule for all equipment. Testing & commissioning reports of all electrical equipment

22) The Contractor shall provide and install all necessary hoists, ladders, scaffolding, tools, tackles, all transport for labor and materials and plants necessary for the proper execution and completion of the work to the satisfaction of the Engineer / Employer.

23) The cost of constructing pillars, platforms for temporary works is also to be borne by the Contractor.

SCOPE OF WORK FOR HVAC:

The Contractor should design and built adequate Ventilation system (Natural-cum-Electrical) in the constructed parking building which will be tested for performance before acceptance.

1) The contractor for the system shall include all necessary equipment for providing a smoke free environment. The system shall also meet the requirements of NBC.

2) The Ventilation System shall consist of Jet Fans / Exhaust Fans of required capacities located at various places for proper ventilation.

3) The Contractor should supply, install, test & commission the complete system.

4) The Contractor should carry out the Smoke Test/CFD Analysis to the satisfaction of the Engineer / Employer.

5) The Contractor should provide entire split AC units of adequate capacity complete with all accessories and Air-cooled condensing unit with outdoor support structure as required

   However for All Collection / Dispensing / Security Booths, Window ACs of adequate capacities shall be provided by the Contractor.

The Contractor shall take care of following requirements while installing the split AC system:

a) The outdoor support structure shall be painted with 2 coats of epoxy primer and 2 coats of epoxy paint.
b) Electrical panel with starters etc., for compressor motor condenser fan motor, evaporator motor interlock local isolators for motors.
c) Operating thermostat and safety controls.
d) Installation accessories mounting brackets, refrigerant piping, filter, drier etc.
e) First charge of R – 22 refrigerant gases.
f) Breaking holes, sleeves and making good.
g) Drain piping for evaporator unit.
h) Insulation of indoor unit, refrigerant piping and drain piping.
i) Electrical wiring for the power supply units as per load factor.
j) These AC units must have inbuilt mechanisms which can be used to increase the temperature in an extremely cold climate to normal room temperature.

Annexure – D : Scope of Works for Car Parking Management System and Instrumentation

Scope:

With regard to car parking management systems, the following aspects including all required soft-wares are to be provided by the contractor:-

1. Semi customized automatic car parking management systems
2. Boom barriers with signals
3. Guidance systems,
4. System integration including recommendation of appropriate technologies,
5. Driveway internal sign boards and display boards including level markers,
6. Pedestrian directions,
7. Highly sophisticated access systems and safety mechanisms including installation of CCTV and reflecting mirrors at required locations.
8. Installation of Biometric attendance system for recording of daily attendance during O&M period.

Entry / Exit Areas

a) All barriers for entries shall be located away from the traffic junction and exit locations.

b) The entry and exit of vehicles shall be provided so that it does not hinder pedestrian movements and shall under no circumstances be far from Walkways.

c) The Entry and Exit areas must be sized to allow drivers to safely and comfortably drive in and out the vehicle.

d) Turning radius and width of drive aisles and minimum clear width of Entry and Exit Areas shall be designed according to the respective needs and leaving adequate space to the left and right of the car for passengers to leave / enter.

e) The Entry Areas shall be equipped with sensors to ensure the right positioning of the vehicle to be parked as well as to determine the presence of oversized vehicles, protruding mirrors or racks / carriers, which exceeds the size limitation of the system.

f) For Semi Automated parking, Sensors or similar devices shall be installed inside the Entry and Exit areas to ensure that no person or small animal is inside the ground level of the puzzle parking system when the machine starts moving.

g) Safety locks / emergency switches shall be installed to stop any machinery if a person or animal is detected inside the puzzle parking system.

Security

i. Security check points must be provided by the contractor with state of the art automatic barriers for vehicle checking on both entry and exit.

Annexure – E : Scope of Works for Operation & Maintenance

1. Operation & Maintenance of whole Facility for Ten (10) years after the date of issue of completion certificate including the defect liability period of two year. However during defect liability period the cost of Operation (Operational manpower namely operators , watch and ward, traffic regulators, health and safety, fuel and lubricants for DG sets, or any other requirement to Operate the system 24x7 shall be borne by the contractor.

2. The necessary fixtures and furniture required for Contractor's office during O&M period shall be provided by the Contractor at no extra cost and shall remain property of the Contractor.

3. Operation and Maintenance of the Car Parking Systems and maintenance for all the assets and mechanisms installed for Electrical Systems, Plumbing, HVAC, Fire Prevention Systems, Fire Fighting Systems, Rain Water Harvesting Systems and the Civil Building (Office block) will be in the scope of work of the contractor.

4. The Cost of Operation & Maintenance for Ten (10) years shall be borne by the contractor from the revenue generated through the parking and advertising.

5. All the defective parts will have to be replaced, to an extent, whereby they cannot be repaired during the whole O&M Period.

6. The maintenance for all the equipment's will be comprehensive in nature and it will be contractor's responsibility to replace them as and when required (whether under guarantee period or not) during the whole O&M Period.

7. Operation and Maintenance instruction manuals must be provided by the contractor in 6 sets of hard copy and a soft copy to the Engineer / Employer along with the list of all spare parts to be stored at site for effective maintenance of the entire systems during the defect liability period and during the maintenance contract.

8. The contractor must ensure that he also submits a separate list of the spare parts to be imported and these spare parts must be stored at site immediately after the commissioning of the parking systems.

9. The contractor must maintain at least 5 sets of spare parts for those equipment's which are utilized for safety in semi automatic car parking systems.

10. The contractor shall use only the original and genuine spares of the original equipment as per recommendations given in the maintenance booklet of the manufactures. Adequate stock of such spares is to be maintained by the contractor. Test certificate of the manufacturer for all major equipment including bearings will be submitted by the Contractor to GVSCCL/GVMC.

11. If any material brought upon the site of works or to the places where Operations have been or are being carried out in connection with or for the purpose of the works, be in the judgment of the GVSCCL/GVMC, of an inferior or improper description or improper be used in the works, the said materials or workmanship shall where required by the said officer be removed or amended by the contractor forthwith or within such period for every breach by the contractor in this clause, the GVSCCL/GVMC is authorized to remove or cause to be removed the materials and workmanship so objected to or any part thereof and replace the same with such other materials and workmanship as shall be satisfactory to GVSCCL/GVMC.

12. The Contractor should make sure that all the equipments to be replaced at site during the defect liability period and during the comprehensive maintenance period reach the site in proper packaging, without any mishandling and the details of which must be given to the GVSCCL/GVMC every month in his report.

13. The Electricity & Water charges during O&M period shall be borne by contractor. In case of power failure, the DG sets shall be Operated and cost on account of POL for these DG sets shall be reimbursed by contractor.

14. The contractor must provide adequate labor, materials, tools and equipments during Operation and maintenance period.

15. The car parking systems and equipments covered under the above contract shall be promptly attended by the contractor including any 'Trouble Shooting' to ensure smooth and trouble free Operation.

16. Regular drills (at least once in a month) will be carried out by the contractor to check the quality of all the equipments during Operation and maintenance period. The report of the same shall be given to the GVSCCL/GVMC after every quarter.

17. The contractor has to make sure that proper fire extinguishers are used to cover any kind of fire during any mishap within the total boundary area including machineries. The expiry period of refills of various fire extinguishers should be watched and maintained during the period of contract.

18. The Contractor must be responsible for the regular maintenance of the created facility as described in the supplied manual.

19. The Contractor must take minimum 5 years guarantee for all the equipments he purchases from respective vendors.

20. During O&M period, the Contractor will also regularly maintain all constructed structures. During this period, the daily cleaning and maintenance of site premises shall be arranged by the Contractor at no additional cost.

21. The contractor has to maintain all the toilets for proper use of his own office and that of GVSCCL/GVMC.

22. In case of battery Operated auto system panels and also system alarm etc., batteries are required to be maintained and replaced as and when needed by the contractor at no extra cost.

23. POL (Petrol/Diesel Oil & Lubricants) has to be arranged by the contractor as and when needed as per manufactures recommendations for periodical maintenance of entire system.

24. The Contractor shall program inspection/monitoring of the project facility for its good upkeep and smooth Operations. The inspection/monitoring shall be covering all the elements of Project facility including building structure, electrical and mechanical systems, sign boards, service standards etc.

25. In case of major repair due to normal wear and tear/break down, the contractor should bring the same to the notice of the GVSCCL/GVMC immediately and necessary measures for its repair should be taken simultaneously. Breakdown, all repairs of any kind are to be attended by the contractor.

26. The Contractor shall also take care for the on-site personal training of its employees for the emergency Operations.

27. The Contractor shall maintain logbook of planned and reactive maintenance.

28. Any loss or theft to the equipments in the store room will be totally the responsibility of the contractor.

29. The contractor shall not remove/shift any equipments/machinery even temporarily without written permission of the GVSCCL/GVMC or authorized representative.

30. The Contractor shall attend immediately to all the complaints with reference to O&M of the entire system.

31. GVSCCL/GVMC will be at liberty to post its staff for surveillance/ inspection at the Facility along with access to all units, control room and records, log books, MIS (Management Information system), data etc. round the clock as required. The logbooks and other records shall be properly maintained and any cutting should be attested by the staff from authorized employer officials and this record shall be open for further inspection / checking by GVSCCL/GVMC for further action/improvements/rectifications.

32. All the equipment, building land etc. shall remain the property of GVSCCL/GVMC.

Staffing

a) The contractor in each shift of Operation must provide minimum number of qualified employees as mentioned in the indicative list of Personnel Requirements for Operation and Maintenance. However a tentative list of actual number of employees required for O&M services shall be provided by the Contractor during the preparatory period. The list of actual number of employees required for O&M services shall be finalized after submission of O&M Manuals.

b) In addition, the contractor will provide unskilled personnel during O&M of the facilities as per requirements.

c) The O&M shall be carried out on a 24x7 basis, without intermission and the staff deployed by the contractor shall be in accordance with this contract.

d) The staff in each shift shall record their attendance electronically operated biometric system.

e) The contractor shall provide to his staff all necessary superintendence during the O&M.

f) Such superintendence shall be given by a competent person having adequate knowledge of the Operation and Maintenance to be carried out (including the methods and techniques required), the hazards likely to be encountered and methods of preventing accident as may be required for the satisfactory working of the entire Facility.

g) The contractor shall ensure that the staff employed takes all necessary precautions while carrying out the work either in shift duties or any general shift.

h) The staff engaged shall wear common uniform with name plate indicating name and designation during duty hours.

i) Any dispute among the contractor's staff shall be resolved by the Contractor and in no way shall GVSCCL/GVMC be responsible for the disputes between them.

j) The contractor shall follow the rules and regulations as per Labor Act / Factory Act, as applicable.

k) The contractor shall give his telephone no., contact addresses, etc. to the GVSCCL/GVMC as well as shift duty staff to contact him during emergency/odd hours etc.

Safety/Security

i. The contractor shall take all safety precautions under various Acts/Rules, under central/State Govt. from time to time and he shall be responsible for safety of its staff and the consequences thereof.

ii. The contractor shall deploy round the clock Watch and ward staff - security personnel at entrance of the premises and in the compound for the safety of the Facility during the O&M period.

iii. The contractor shall be completely responsible for the safety of the entire car parking area, all its equipments and all other electrical, HVAC and mechanical components and all his personnel during this period.

iv. The care of the whole of the car parking area shall remain with the contractor who shall be responsible for all accidents or damages due to causes attributable to him.

v. Adequate safety precautions against fire, flooding, lightening, electrical shocks, accident due to moving/non-moving heavy/light equipments shall be strictly observed by the contractor at his own cost.

vi. Suitable safety measures like gumboots, gloves, safety belts, ladders, safety lamps, gas masks, insulated tools, alarms etc. shall be provided by the contractor.

vii. Necessary medical first aid kit shall be made available at all times.

viii. In absence of observance of above safety precautions, the contractor shall be responsible for any unforeseen loss of the equipments or persons dealing with it.

ix. In case of any injury / loss to the workmen / plant and equipment, the contractor shall inform employer immediately within 12 hrs of the occurrence of the event. The facilities will be open to local/state/central agencies for verification of safety/emission/acts compliance.

x. During night hours, the main entrance should be closed. However, shift duty staff should be alert and open the road during surprise checking of GVSCCL/GVMC staff or any other Government Authorities or its nominees.

xi. Only bona-fide persons will be allowed in the premises, being a prohibited area. Smoking and drinking are strictly prohibited in the premises.

Reporting

1. The Contractor will prepare monthly reports and quarterly reports and submit the same to the GVSCCL/GVMC. The reports shall contain, inter-alia, the following:
   - A description of the maintenance work carried out in the reporting period.
   - A report on major failures, if any, their causes and remedial actions taken.
   - List of spare parts consumed in the reporting period from the store room.
   - Any change in inventory of the material in the store room with additions and subtractions shown at the end of the reporting period.
   - O&M staff deployed by the contractor during the reporting period.
   - Any major repair works, if any.

2. GVSCCL/GVMC will be at liberty to post its staff for surveillance/ inspection at the Facility along with access to all units, control room and records, log books, MIS (Management Information system), data etc. round the clock as required. The logbooks and other records shall be properly maintained and any cutting should be attested by the staff from authorized employer Officials and this record shall be open for further inspection/checking by GVSCCL/GVMC for further action/improvements/rectifications.
3. The GVSCCL/GVMC reserves the right to carry out any work including capital works in the created Facility for improvement of the performance of the system. The contractor shall not obstruct/ create hindrance to any such work/works by GVSCCL/GVMC or its authorized agencies.
4. All the equipment, building land etc. shall remain the property of GVSCCL/GVMC.

Technical Audit

The GVSCCL/GVMC has the right to conduct a technical audit of the Facility and to perform any analysis or inspection if deemed necessary. Before any such inspection, GVSCCL/GVMC shall give a prior written notice of three days to the Contractor. The contractor shall at the Contractor's sole cost and expenses provide all assistance to GVSCCL/GVMC required for such inspections. Such audits may cover all or any of the obligations of the Contractors, including, without limitation, the following:

(a) Verification of the entire car parking system during the O&M period.
(b) Verification of the performance standards and life of the individual assets of the facility, for normal wear and tear during O&M period.
(c) Verification of the capacity of the facility to meet functional guarantees.

Facility Visits

(i) At any time or at the end of each twelve month period, or at the initiative of the GVSCCL/GVMC, a visit shall be organized so that both parties can check the condition of the installations at the facility.

(ii) A report shall be drawn up to record the opinions of the both parties. The GVSCCL/GVMC reserves the right to call the equipment manufacturers or specialized technicians for these visits. All expenses are to be borne by the contractor for these purposes.

Training

The Contractor shall plan and develop the course content, and implement on-the-job and classroom based training, for GVSCCL/GVMC deputed staff of at least 15personnel in 3 batches of 5 personnel each, during first 6 months of the Operation & Maintenance period. The Contractor shall organize training for identified managers from amongst the GVSCCL/GVMC deputed staff in technical aspects of semi automatic car

parking systems to enable GVSCCL/GVMC to build sufficient capacity and skills to manage the said car parking systems at a later date if required.

This training would include training in overhauling and replacement of various components of Semi Automatic Car Parking Systems, Electrical Systems, Plumbing, HVAC, Fire Prevention Systems, Fire Fighting Systems, Rain Water Harvesting Systems and expertise in Maintenance of the entire Office block.

7.2 SPECIFICATIONS

A) Civil and Steel Components including Sanitary & Plumbing works, Drainage & Sewage Works, Rain Water Harvesting Systems, Landscaping and Revamping of existing Police Chowki Parking area

1. All Civil Works, including Sanitary & Plumbing, Drainage & Sewage, Rain Water Harvesting etc. shall be executed as per CPWD Specifications and relevant latest IS codes.
2. The office block shall be designed as RCC framed structure to be constructed in Seismic Zone – II.
3. The RCC Work shall be executed as per approved Drawings and Designs. The loading will conform to the standards as follows:

   Dead load for all permanent structures: IS 875 (Part 1)

   Live load: IS 875 (All 5 Parts)

   Seismic load: IS 1893

   Floor load other than car parking levels (unless required higher otherwise): 200 kg/m^2

   Staircase load: 400 kg/m^2

   Floor load for car parking areas: 400 kg/m^2 (or at actual with safety factor, whichever is higher)
4. Due to nature of application, the structure will be subjected to dynamic loading. The structures shall be designed for adequate rigidity and stability in all directions apart from dead and superimposed loads.
5. All walls shall be in brickwork of 225 mm thickness constructed in Cement Mortar 1:4.
6. Road Work shall be executed as per MoRT&H Specifications.
7. **Finishing Items of buildings:**

7.1 **Interior Finishes:**

7.1.1 Ceiling and Walls:

Puzzle Parking System

The walls of the Ground floor and all the walls of other floors shall be plastered in Cement Mortar Mix 1:4 and the ceiling of G.F. shall be finished in Cement Mortar 1:3 finished with neat cement punning both on walls as well as on ceiling.

The interior (walls & ceiling) of all Car Parking levels except Ground Floor Level of Car Parking Building shall be provided with a coat of grey cement wash.

The interior of Ground Floor Level including Control Room, Server Room, D.G. Set / Battery Room (Area excluding Tiled Portion) and Machine Rooms of Car Parking Building shall be

finished with Oil Bound Washable Distemper of approved Shade & Make with Cement Primer over two coats of Cement based putty.

7.1.2 Flooring:

The flooring of Ground Level and Approach Roads shall be of Cement Concrete Pavement which shall be designed to carry out the impact load of the vehicles.

The flooring for Control Room, Server Room, etc. shall be finished with 600 x 600 mm Vitrified Tiles of approved Shade & Make over 20 mm thick Cement Mortar of Mix 1:4 as per IS : 15622

The flooring of D.G. Set / Battery Room shall be finished with 10 mm thick Acid Resistant Tiles of approved Shade and Make as per IS : 4457. The Side walls shall also be finished with Acid Resistant Tiles of approved Shade & Make up to 1.50 m height as per IS : 13753.

The Footpaths / Pathways shall be finished with Cement Concrete Inter-locking tiles, minimum 65 mm thick, of approved Shade & Make over a bed of 150 mm thick sand.

7.2 **Exterior Finishes:**

The exposed columns in the entire area – if any, shall be provided with cladding of 2 mm thick ACP sheets of approved shade fixed over the steel frame capable of tacking the impact of vehicle.

The Exterior of Control Room, Server Room, D.G. Set / Battery Room, etc. shall plastered with Cement Mortar Mix 1:4. The exterior walls of this office block shall be finished with exterior Weather Coat Paint of approved Shade & Make over exterior cement primer as per relevant specifications.

8. Doors & Windows:

The required No. of Doors & Windows of Control Room, Server Room, etc. shall be of Powder Coated Aluminium Sections of 3 mm thickness as per relevant specifications and as approved by the Engineer / Employer. The door shutters shall be partly panelled and partly glazed with toughened glass of minimum 6 mm thickness. The panelling shall be provided with both sides pre-laminated board of 12 mm thickness. All hardware fixtures shall be of approved make.

Fully panelled PVC doors with frames shall be fixed in Bathrooms. The windows / ventilators shall be of Powder Coated Aluminium Sections of 3 mm thickness as per relevant specifications and as approved by the Engineer / Employer.

The glass panes of windows / ventilators shall be provided with toughened glass of minimum 6 mm thickness.

M.S. Rolling Shutter shall be provided in D.G. Set / Battery Room. The windows / ventilators in these rooms shall be of shall be Powder Coated Aluminium Sections of 3 mm thickness as per relevant specifications and as approved by the Engineer / Employer.

9. Water Proofing:

Top Floor Roof Slabs of all the Buildings shall be finished with proper treatment of Water Proofing of approved specifications with either of the brands namely FOSROC / CICO / TEXAS through their authorized applicators only. .

9.1 Pipes and Specials

Water pipe lines with clamps and specials etc. shall be described by their diameter and length measured in running m inclusive of joints.
If the joints, special and fittings etc. are required to be separated, it shall be so stated and enumerated.
Transporting of useful material such as pipes, valves, steel items to the Stores of respective departments or as directed by the Engineer / Employer.

10. Carriage of Materials:

10.1 Scope

This Specification covers the general requirements for carriage of materials.

10.2 General

The carriage and stacking of materials shall be done as directed by the Engineer. Any tools and plants required for the work shall be arranged by the Contractor. The pipes and specials shall be carried from manufacturer works / agency / supplier to the site of work.

10.3 Responsibility for Loss or Damage

Loading, carriage, unloading and stacking shall be done carefully to avoid loss or damage to the materials.

10.4 Mode of Carriage

Depending upon the feasibility and economy, the Engineer shall determine the mode of carriage viz. whether by mechanical or manual labor.

10.5 Stacking, Covering and Protection

Material shall be stacked in such a manner as to ensure the preservation of their quality and fineness for the work. Different types of materials shall be stacked separately and in such a way that counting and measurements can be done without disturbing the stacks. Any material that is liable to

be affected by rain or other adverse weather conditions shall be covered and protected properly against the same.

Earth, dismantled materials, malba and other similar materials shall be stacked as directed by the Engineer.

Cement bags, steel bars, structural steel sections, bricks and timber and other similar materials shall be stacked in proper manner.

Pipes of, D.I., / D.I. fittings, HDPE pipes, valves etc. shall be stacked as per manufacturers/suppliers instructions or as directed by the Engineer.

Stone metal, sand and such similar materials shall be stacked as directed by the Engineer.

11. **Shoring:**

Earthwork in cutting shall be retained by designed Steel Shoring as per relevant code.

If slips, slides, over-breaks or subsidence occur in cuttings during the process of construction, they shall be removed at the cost of the Contractor as ordered by the Engineer. Should slips occur, the slipped material shall be removed and the slope dressed to a modified stable slope. Removal of the slipped earth will not be paid for if the slips are due to the negligence of Contractor. Adequate precautions shall be taken to ensure that during construction, the slopes are not rendered unstable or give rise to recurrent slides after construction. If finished slopes slide into the excavated area subsequently, such slides shall be removed.

12. **Preservation of Property:**

The Contractor shall undertake all reasonable precautions for the protection and preservation of any or all existing roadside trees, drains, sewers or other sub-surface drains, pipes, conduits and any other structures under or above ground, which may be affected by construction Operations and which, in the opinion of the Engineer, shall be continued in use without any changes. Safety measures taken by the Contractor in this respect, shall be got approved from the Engineer. However, if any of these objects is damaged by reason of the Contractor's negligence, it shall be replaced or restored to the original condition at his expense. If the Contractor fails to do so, within the required time as directed by the Engineer or if, in the opinion of the Engineer, the actions initiated by the Contractor to replace / restore the damaged objects are not satisfactory, the Engineer shall arrange the replacement / restoration directly through any other agency at the risk and cost of the Contractor after issuing a prior notice to the effect.

13. **Works to be Kept Free of Water:**

The Contractor shall arrange for the rapid dispersal of water collected / accumulated on the earthwork or completed formation during construction or on the existing roadway or which enters the earthwork or any other item of work from any source, and where practicable, the water shall be discharged into the permanent outfall of the drainage system. The arrangement shall be made in respect of all earth work including excavation for pipe trenches, foundations or cuttings.

The Contractor shall provide, where necessary, temporary water courses, ditches, drains, pumping or other means for maintaining the earthwork free from water. Such provisions shall include carrying out the work of forming the cut sections and embankments in such manner that their surfaces have at all times a sufficient minimum cross-fall and, where practicable, a sufficient longitudinal gradient to enable them to shed water and prevent ponding.

The works involved in keeping the earthwork or any other item of works free of water shall be deemed as incidental to the respective item of work.

14. Materials:

14.1 Scope

Materials to be used in the work shall conform to the specifications mentioned on the drawings, the requirements laid down in this section and specifications for relevant items of work covered under these specifications.

If any material, not covered in these specifications, is required to be used in the work, it shall conform to relevant Indian Standards or international standards (in the absence of Indian standards) or to the requirements specified by the Engineer.

14.2 Sources of Material

The contractor shall notify the Engineer of his proposed sources of materials prior to delivery. If it is found after trial that sources of supply previously approved do not produce uniform and satisfactory products, or if the product from any other source proves unacceptable at any time, the contractor shall furnish acceptable material from other sources at his own expense.

14.3 Bricks

Burnt clay bricks shall conform to the requirement of IS: 1077, except that the minimum compressive strength when tested flat shall not be less than 7.5 MPa for individual brick. They shall be free from cracks and flaws and nodules of free lime. The brick shall have smooth rectangular faces with sharp corners and emit a clear ringing sound when struck. The size may be according to local practice with a tolerance of ± 5 per cent.

14.4 Cement

Cement to be used in the works shall be any of the following types with the prior approval of the Engineer. These have to be procured from reputed ISO: 9000 organizations:

- Ordinary Portland Cement, 43 Grade, conforming to IS: 12269
- Rapid Hardening Portland Cement, conforming to IS: 8041.
- Portland slag cement, 53 Grade conforming to IS: 455.
- Pozzolana Portland Cement (PCC) conforming to IS: 1489.

Cement conforming to IS: 8041 shall be used only for precast concrete products after specific approval of the Engineer.

14.5 Coarse Aggregates

For plain and reinforced cement concrete (PCC and RCC) or works, coarse aggregate shall consist of clean, hard, strong, dense, non-porous and durable pieces of crushed stone or granite or other

approved inert material. They shall not consist pieces of disintegrated stones, soft, flaky, elongated particles, salt, alkali, vegetable matter or other deleterious materials in such quantities as to reduce the strength and durability of the concrete, or to attack the steel reinforcement. Coarse aggregate having positive alkali silica reaction shall not be used. All coarse aggregates shall conform to IS: 383 and tests for conformity shall be carried out as per IS: 2386 Parts I to VIII.

The contractor shall submit for the approval of the Engineer, the entire information indicated in appendix A of IS: 383.

Nominal size of coarse aggregate for various components in PCC & RCC is mentioned in BOQ. In case of discrepancy the decision of the Engineer is final.

The maximum value for flakiness index for coarse aggregate shall not exceed 35 percent. The coarse aggregate shall satisfy the following requirements of grading:

IS Sieve Size	**Percent by Weight Passing the Sieve**		
	40 mm	**20 mm**	**12.5 mm**
63 mm	100	-	-
40 mm	95-100	100	-
20 mm	30-70	95-100	100
12.5 mm	-	-	90-100
10 mm	10-35	25-55	40-85
4.75 mm	0-5	0-10	0-10

14.6 **Sand/Fine Aggregates**

For masonry work, sand shall conform to the requirements of IS: 2116.

For plain and reinforced cement concrete (PCC and RCC) works, fine aggregate shall consist of a suitable combination of natural sand. They shall not contain dust, lumps, soft or flaky, materials, mica or other deleterious materials in such quantities as to reduce the strength and durability of the concrete, or to attack the embedded steel. Sand washing machines should be used to remove impurities from sand. Fine aggregate having positive alkali-silica reaction shall not be used. All fine aggregate shall conform to IS: 383 and test for conformity shall be carried out as per IS: 2386 (Part I to VIII). The contractor shall submit to the Engineer the entire information indicated in Appendix A of IS: 383. The fineness modulus of fine aggregate shall neither be less than 2.0 nor greater than 3.5.

Sand/fine aggregate for structural concrete shall conform to the following grading requirement

IS Sieve Size	**Percent by Weight Passing the Sieve**		
	Zone I	**Zone II**	**Zone III**
10 mm	100	100	100

IS Sieve Size	Percent by Weight Passing the Sieve		
	Zone I	**Zone II**	**Zone III**
4.75 mm	90-100	90-100	90-100
2.36 mm	60-95	75-100	85-100
1.18 mm	30-70	55-90	75-100
600 micron	15-34	35-59	60-79
300 micron	5-20	8-10	12-40
150 micron	0-10	0-10	0-10

14.7 **Steel**

- Reinforcement

For reinforced cement concrete (RCC) works, the reinforcement / un tensioned steel as the case may be shall consist of the following grades of reinforcing bars:

Grade Designation	**Bar type conforming to governing IS specification**	**Characteristic strength Mpa**	**Elastic Modulus GPa**
Fe 500 D	IS : 1786 High Yield Strength Deformed Bars	500	200

All steel shall be procured from original producers, or their authorized re-rollers.

Only new steel shall be delivered to the site. Every bar shall be inspected before assembling on the work and defective, brittle or burnt bar shall be discarded. Cracked ends of bars shall be discarded.

Utmost care should be taken so that bars are not damaged during handling and transportation.

- Structural Steel

Unless otherwise permitted herein, all structural steel shall before fabrication comply with the requirement of the following Indian Standards:

IS: 226	Structural Steel (Standard Quality)
IS: 2062	Wieldable Structural Steel
IS: 1730	Dimension for Steel Plate, sheet and strip for structural and general engineering purposes

IS: 1731	Dimension for Steel flats for structural and general engineering purposes

The use of structural steel not covered by the above standards may be permitted with the specific approval of the Engineer.

14.8 **Bitumen**

The bitumen shall be paving bitumen of Viscosity Grade VG-30 (60/70) as per Indian Standard Specifications for "Paving Bitumen" IS: 73. Guidance to selection of the grade of bitumen may be taken from Appendix 4 of MORT&H Specifications for Roads and Bridge Works (IV Revision).

14.9 **Water**

Water used for mixing and curing shall be clean and free from injurious amounts of oils, acids, alkalis, salts, sugar, organic materials or other substances that may be deleterious to concrete or steel. Potable water is generally considered satisfactory for mixing concrete.

14.10 **Concrete Admixtures**

- General

Admixtures are materials added to the concrete before or during mixing with a view to modify one or more of the properties of concrete in the plastic or hardened state.

Concrete admixtures are proprietary items of manufacture and shall be obtained only from established manufacturers with proven track record, quality assurance and full-fledged laboratory facilities for the manufacture and testing of concrete.

The Contractor shall provide the following information concerning each admixture after obtaining the same from the manufacturer:

i. Normal dosage and detrimental effects, it any, of under dosage and over dosage.
ii. The chemical names of the main ingredients in the admixtures.
iii. The chloride content, if any, expressed as a percentage by weight of the admixture.
iv. Values of dry material content, ash content and relative density of the admixture which can be used for Uniformity Tests.
v. Whether or not the admixture leads to the entertainment of air when used as per the manufacturer's recommended dosage and it so to what extent.
vi. Where two or more admixtures are proposed to be used in any one mix, confirmation as to their compatibility.
vii. There would be no increase in risk of corrosion of the reinforcement or other embedment's as a result of using the admixture.

- Physical and Chemical Requirements

Admixtures shall conform to the requirements of IS: 9103. In addition, the following conditions shall be satisfied:

i. Synthetic fiber (Polyester 12mm Recron 3S) triangular; admixtures shall be added in all concrete works.
ii. "Plasticizers", "Super - Plasticizers" shall meet the requirements indicated for "Water reducing Admixture".
iii. Except where resistance to freezing and thawing and to disruptive action of deicing salts is necessary, the air content of freshly mixed concrete in accordance with the pressure method given in IS: 1199 shall not be more than 2 per cent higher than that of the corresponding control mix and in any case not more than 3 per cent of the test mix.
iv. The chloride content of the admixture shall not exceed 0.2 per cent when tested in accordance with IS: 6925. In addition, the maximum permissible limit of chloride content of all the constituents (not to exceed 1.5% of the weight of cement in each batch of concrete) shall also be observed.
v. Uniformity tests on the admixtures are essential to compare qualitatively the composition of different samples taken from batch to batch or from the same batch at different times.

The tests that shall be performed along with permissible variations in the same are indicated below:

- Dry Material Content: to be within 3 per cent and 5 per cent of liquid and solid admixtures respectively of the value stated by the manufacturer.
- Ash content: to be within 1 per cent of the value stated by the manufacturer.

Relative density (for liquid admixtures): to be within 2 percent of the value stated by the manufacturer.
All tests relating to the concretes admixtures shall be conducted periodically at an independent laboratory and compared with the date given by the manufacturer.

15. Storage of Materials:

15.1 General

All materials may be stored at proper places so as to prevent their deterioration or intrusion by foreign matter and to ensure their satisfactory quality and fitness for the work. The storage space must also permit easy inspection, removal and re-storage of the materials. All such materials even though stored in approved good-owns /places, must be subjected to acceptance test prior to their immediate use.

15.2 Bricks

Bricks shall not be dumped at site. They shall be stacked in regular tiers as they are unloaded, to minimize breakage and defacement. The supply of bricks shall be available at site at any time. Bricks selected for use in different situations shall be stacked separately.

15.3 Aggregates

Aggregate stockpiles may be made on ground that is denuded of vegetation, is hard and well drained If necessary, the ground shall be covered with 50 mm plank or brick flat soling. Coarse aggregates shall be delivered to the site in separate sizes agreed by the Engineer in writing.

In the case of fine aggregates, these shall be deposited at the mixing site not less than 8 hours before use and shall have been tested and approved by the Engineer.

15.4 **Cement**

Cement shall be transported, handled and stored on the site in such a manner as to avoid deterioration or contamination. Cement shall be stored above ground level in perfectly dry and water-tight sheds and shall be stacked not more than eight bags high. Wherever bulk storage containers are used their capacity should be sufficient to cater to the requirement at site and should be cleaned at least once every 3 to 4 months.

Each consignment shall be stored separately so that, it may be readily identified and inspected and cement shall be used in the sequence in which it is delivered at site. Any consignment or part of a consignment of cement which had deteriorated in any way, during storage, shall not be used in the works and shall be removed from the site by the Contractor without charge to the Employer.

The Contractor shall prepare and maintain proper records on site in respect of delivery, handling, storage and use of cement and these records shall be available for inspection by the Engineer at all times.

The Contractor shall make a monthly return to the Engineer on the date corresponding to the interim certificate date, showing the quantities of cement received and issued during the month and in stock at the end of the month.

15.5 **Reinforcement Steel**

The reinforcement bars, when delivered on the job, shall be stored above the surface of the ground upon platforms, skids, or other supports, and shall be protected from mechanical injury and from deterioration by exposure.

15.6 **Pipes**

The pipes shall be transported and handled as per IS: 12288. All precaution set out shall be taken out to prevent damage to the protective coating, damage of the jointing surfaces or the ends of the pipes

The pipes shall be stacked in layers on dry surface preferably on the projected bench/ surface

All the pipe specials, rubber rings / joints, nut, bolts including valves etc. shall be stored in closed room or shed.

15.7 **Mechanical Items**

All the items of mechanical required shall be stored in closed room or shed with original packing.

15.8 **Mild steel (M.S) appurtenances**

Special fittings such as bends of odd size angle, flanged and socket tees, gap pieces, tail pieces, tapered flanged pipe nipple and other fittings required as per the site requirement shall be fabricated from MS pipe and steel. The special so fabricated shall be having protection coat and paint against corrosion.

15.9 **Fittings And Fixtures**

All the fittings and fixtures shall be supplied and fixed as per relevant standards or as directed by the Engineer.

15.10 **Water**

Water shall be stored in containers / tanks covered at top and cleaned at regular intervals in order to prevent intrusion by foreign matter or growth of organic matter. Water from shallow, muddy or marshy surface shall not be permitted. The intake pipe shall be enclosed to exclude silt, mud, grass and other solid materials and there shall be a minimum depth of 0.60 m of water below the intake at all times.

16. **Tests and Standards of Acceptance:**

All materials, even though stored in an approved manner shall be subjected to an acceptance test prior to their immediate use. Independent testing of cement for every consignment shall be done by the Contractor at site or in a laboratory approved by the Engineer before use. Any cement with lower quality than those shown in manufacturer's certificate shall be debarred from use. In case of imported cement, the same series of tests shall be carried out before acceptance.

16.1 **Testing and Approval of Material**

The Contractor shall furnish test certificates from the manufacturer/supplier of materials along with each batch of material(s) delivered to site. Tests shall be as specified in QA/QC Manual.

The Contractor shall set up a field laboratory as per MoRT&H Standard with necessary equipment for testing materials, finished products used in the construction as per requirements of conditions of contract and the relevant specifications. The testing of all the materials shall be carried out in the presence of the Engineer or his representative for whom the contractor shall make all the necessary arrangements bear the entire cost.

Tests which cannot be carried out in this field laboratory have to be got done at the contractor's cost at any recognized reputed laboratory/testing establishments approved by the Engineer.

16.2 **Sampling of Materials**

Samples provided to the Engineer or his representatives for their retention are to be in labeled boxes suitable for storage.

Samples required for approval and testing must be supplied well in advance by at least 48 hours or minimum period required for carrying out relevant tests to allow for testing and approval. Delay to works arising from the late submission of samples will not be acceptable as a reason for delay in the completion of the works.

If materials are brought from abroad, the cost of sampling/testing whether in India or abroad shall be borne by the Contractor.

16.3 **Rejection of Materials not conforming to the Specifications**

Any stock or batch of material(s) of which sample(s) does not conform to the prescribed tests and quality shall be rejected by the Engineer and such materials shall be removed from site by the Contractor at his own cost. Such rejected materials shall not be made acceptable by any modifications

16.4 **Testing and Approval of Plant and Equipment**

All Plants and equipment used for preparing, testing and production of materials for incorporation into the permanent works shall be in accordance with manufacturer's Specifications and shall be got approved by the Engineer before use.

17. **Other Specifications:**

17.1 To ensure quality of work, the contractor shall set up and maintain at his own expense a "TESTING LABORATORY" of minimum 15 Sqm. area at site. He should provide all Laboratory apparatus and equipment as per MoRT&H Standard.

17.2 The laboratory should be staffed by full time qualified technicians and have a helper who can be a worker on the site.

17.3 Minimum one week before the actual commencement of construction, the contractor shall supply to the Architects/Structural Consultant drawings showing the general detailed arrangement for concreting (e.g. -formwork, staging, centring, bar-bending schedules, actual placing arrangement at site, sequence of concreting etc.) for approval.

17.4 All materials which have been damaged, contaminated or have deteriorated or do not comply in any way with the requirements of this specification shall be removed from the site at the Contractor's own expense.

17.5 The concrete mix shall be designed by recognized methods. The proportions chosen shall be such that the concrete is cohesive and of adequate workability and durability for the conditions prevailing on the work in question and can be properly compacted without segregation.

18. **SAFETY CODE**:

20. 1 First aid appliance shall be maintained in a readily accessible place including adequate supply of sterilized dressings and cotton wool.

20. 2 An injured person shall be taken to a public hospital without loss of time, in cases where the injury necessitates hospitalisation.

20. 3 Suitable and strong scaffolds should be provided for work men for all works that cannot safely be done from ground.

20. 4. No portable single ladder shall be over 8 metres in length. The width between the side rails shall not be less than 30 cm. (Clear) and the distance between two adjacent rungs

shall not be more than 30 cms. When a ladder is used an extra mazdoor shall be engaged for holding the ladder.

20. 5. The excavated materials shall not be placed within 1.5 metres of the edge of the trench or half of the depth of trench whichever is more. All trenches and excavations shall be provided with necessary fencing and lighting.

20. 6. Every opening in the floor of a building or in working platform be provided with suitable means to prevent the fall of persons or materials by providing suitable fencing or railing whose minimum height shall be one metre.

20. 7. No floor, roof or other part of the structure shall be so overloaded with debris or materials as to render it unsafe.

20. 8. Workers employed on mixing and handling material such as asphalt, cement mortar or concrete and lime mortar shall be provided with protective footwear and rubber hand gloves.

20. 9. Those engaged in welding works shall be provided with welder's protective eye-shields and gloves.

20. 10. No point containing lead or lead products shall be used except in the form of paste or readymade paints.

20. 11. Suitable face marks should be supplied for use by the workers when the paint is applied in the form of spray or surface having lead paint dry rubbed and scraped.

20. 12. Overenrolls shall be supplied by the Contractor to the painter and adequate facilities shall be provided to enable the working painters to wash during the periods of sensation of work.

20. 13. Hoisting machines and tackle used in the works, including their attachments, anchorage and supports shall be in perfect condition.

20. 14. The ropes used in hoisting or lowering material or as a means of suspension shall be of durable quality and adequate strength and free from defects.

21 Specifications to be followed by the contractor for puzzle parking systems of steel structure for levels above the ground.

a) ANCHORAGE TO HARDENED CONCRETE

1. Anchorage to hardened concrete shall include mechanical and adhesive anchors of size, number, and spacing as shown on the drawings.

2. Holes shall be drilled and cleaned and anchors shall be installed in strict accordance with the manufacturer's published instructions. Inspection and testing shall be provided in accordance with the general notes.
3. Where a specific type of anchorage is specified on the drawings, substitution for a different type of anchorage (including substituting for cast-in-place anchorage) shall not be permitted without prior written approval.

b) MECHANICAL ANCHORS

1. Acceptable mechanical anchors shall be as follows: hilti "kwik bolt tz" carbon and stainless steel expansion anchor or approved alternative.
2. Unless noted otherwise on the drawings, minimum effective anchor embedment depth shall be 6.5 anchor diameters, minimum distance to the nearest concrete edge shall be 12 anchor diameters and minimum anchor spacing shall be 8 anchor diameters.
3. Stainless steel anchors shall be used at all exterior locations and where specifically indicated on the drawings.
4. No steel Reinforcement shall be cut to install anchors. Defective or abandoned holes shall be filled with non-shrink grout or an injectable adhesive matching the adjacent concrete compressive strength.
5. Notify the structural engineer of defective or abandoned holes in walls and columns. These elements may require non-shrink grout with a compressive modulus of elasticity matching that of the adjacent concrete.

c) ADHESIVE ANCHORS

1. Acceptable adhesive (epoxy) anchors shall be as follows: Hilti "Hilte RE 500" Adhesive anchor or approved alternative. Unless noted otherwise, anchors shall be fe500d reinforcing dowels.
2. Unless noted otherwise on the drawings, minimum effective anchor embedment depth shall be 7.5 anchor diameters, minimum distance to the nearest concrete edge shall be 6 anchor diameters, and minimum anchor spacing shall be 6 anchor diameters.
3. Holes shall be drilled with rotary impact hammer or equivalent method to produce a hole with a rough inside surface. Core drilling holes is not permitted. No reinforcing shall be cut to install adhesive anchors. The adhesive shall be mixed, applied, and cured in strict accordance with the manufacturer's published installation instructions.
4. All placement and curing shall be conducted with concrete.
5. Adhesive shall be applied only to clean, dry concrete. Positive protection shall be provided so that anchors are not disturbed during the curing period.
6. Defective or abandoned holes shall be filled with non-shrink grout or an injectable adhesive matching the adjacent concrete compressive strength. Notify the structural

engineer of defective or abandoned holes in walls and columns. These elements may require non-shrink grout with a compressive modulus of elasticity matching that of the adjacent concrete.

d) NONSHRINK GROUT FOR BASE PLATES, SLEEVES, EMBEDDED STEEL, AND ANCHOR PLATES

1. Grout shall be an approved non-shrink expandable cementitious grout delivered to the job site in factory pre-packaged containers requiring only the addition of water.
2. The minimum 28day compressive strength shall be at least 2 grades higher (m10 higher) than the supporting concrete strength, unless noted otherwise.
3. Grout shall be mixed, applied, and cured strictly in accordance with the Manufacturer's printed instructions.
4. For grouting under base plates and behind anchor plates, grout shall be proportioned as a flowable mix.
5. When a flowable mix does not provide the required strength or when a minimum strength of M70 is required, an epoxy grout shall be used.

e) TOLGVSCCLNCES

1. Standard tolerances shall be based on IS 7215 and IS 486.

f) SEQUENCING CONSTRUCTION AND LATGVSCCLL STABILITY

1. The structural components by themselves are a non-self-supporting structure.
2. Lateral forces due to wind, earthquake, or soil are carried by the roof and floor diaphragms to the lateral system. Certain elements shown on the structural drawings (such as bracing, roof and floor slabs) are required for overall or local stability of other elements (such as beams, columns, and walls).
3. If, due to sequencing of construction, these stability elements are not in place, the contractor shall investigate where temporary shoring/bracing is required and shall design this temporary shoring/bracing.
4. The contractor shall provide this shoring/bracing until the required structural elements and their connections have been installed and reach their final design strengths.

g) STRUCTURAL STEEL

1. All steel shall conform to the following:
2. I-sections, UBS, UCS, etc — IS: 2062, E350 (Fe490)
3. All angles and channels unless noted otherwise — IS: 2062, E350 (Fe490)
4. All other steel unless noted otherwise — IS: 2062, E350 (Fe490)

5. Base plate/gusset plate IS: 2062, E250 (Fe410w)
6. The ratio of fy/fu <= 0.8 preferably, but in any case fy/fu <= 0.85.
7. General notes for steel connections shall apply to all steel connections unless noted otherwise.
8. All work shall be in accordance with the Indian standards. Shop drawings shall be submitted and reviewed by the architect/engineer before commencing fabrication.
9. All steel anchors and ties and other members embedded in concrete or masonry shall be left unpainted.
10. Dimensional tolerance for built up members shall be as per IS 7215.
11. Gas cutting of steel is not allowed.
12. Steel beams are equally spaced between dimension points at the maximum deck span location unless noted otherwise. Minimum camber should be provided in steel beams as shown in structural drawings.
13. Shoring shall be provided to beams, where indicated in structural drawings, to support the weight of wet concrete coming from the slabs. This shoring shall be removed only after the concrete has attained about 80% of the compressive strength. The props shall be spaced at a maximum spacing of 1.2m c/c.
14. The contractor shall be responsible for the design, detailing, and fabrication of all steel framing connections unless specifically detailed on the structural drawings. The contractor shall retain a structural engineer to perform the work, who shall design the connections and submit stamped calculations to the architect / structural engineer for review and approval prior to starting fabrication.
15. Connection design shall meet the requirements of the Indian standards and BS 5950.
16. Connections shall be capable of resisting vertical and horizontal loads listed. The connections should be designed to resist 60% of shear capacity and 90% of moment capacity for beam members, and 100% of member capacity of axially loaded members. Columns should always be spliced using complete joint penetration (CJP) welds.
17. Connection design shall provide an adequate load path to transfer the loads from each member, through the connection, into the supporting member, and shall consider the effects of the forces on each member. Provide stiffener plates, web doubler plates, flange continuity plates, etc, as required. Members shown on the drawings have not been sized for local effects at connections.
18. Steel connection details submitted by the structural engineer show general criteria for design and detailing, and are not intended to show complete connection configurations or other specific information that are the responsibility of the connection design engineer/ contractor/ fabricator. If any connection distances, edge distances, pitch, weld lengths etc. On connection sketches do not match with the minimum or maximum specifications of IS 800:2007, structural engineer should be notified and revised connection sketch should be taken in writing by contractor.

19. Alternative connection configurations may be submitted to the structural engineer for review and approval.
20. Connections specifically detailed on the structural drawings are to be fabricated as shown.
21. The contractor shall be responsible for all erection aids that include, but are not limited to, erection angles, lift holes, and other aids.

h) BOLTED CONNECTIONS

1. All bolts, nuts and washers shall confirm to section 2.4 of IS 800: 2007.
2. All bolts shall be of grade 8.8 unless noted otherwise
3. All bolt holes shall be of standard clearance bolt holes. Unless noted otherwise, oversize and slotted holes should not be provided.
4. Connections shall be a minimum of two-bolt connection using M20 bolts in single shear.
5. All high-strength bolts shall be installed, tightened, and inspected in accordance with IS 3757, IS 4000, IS 6623, and IS 6649. The criteria for slip-critical connections shall apply to all connections unless noted otherwise as snug-tight.
6. Bolts in connections of beam-to-beam/girder/column may be snug tight, unless specifically called out as slip critical (SC).
7. Where connections are noted as snug-tight, the contractor may install per the criteria for snug-tight bolts.
8. All shear type connections in columns, and connections in bracing shall be slip- critical. Slip-critical connections shall use load indicator washers or tension control bolts.
9. All bolts shall be provided with lock washers under nuts or self-locking nuts.

i) STRUCTURAL STEEL WELDING

1. All welding electrodes shall be of type E70XX unless noted otherwise.
2. Structural steel shop drawings shall show all welding with is 813/AWS A2.4 symbols.
3. All welding shall be done by certified welders and in accordance with AWS D1.1 or is 822.
4. Welds shown on the drawings are the minimum sizes. Increase weld size to IS 800 minimum sizes, based on plate thickness. The minimum weld size shall be 6 mm.
5. Field welding symbols have been indicated on the drawings. Where shown, proper field welding per IS 814 and IS 822 shall be used.
6. Where no field welding symbols are shown, it is the contractor's responsibility to use shop welds or clarify with the structural engineer.
7. Unless noted otherwise, all groove welds should be CJP welds
8. All fillet weld sizes shown on drawings refer to weld size and not effective throat thickness.

9. All partial joint penetration groove weld sizes shown on the drawings refer to effective throat thickness.
10. All welds shall be made using low hydrogen electrodes with minimum tensile strength per IS 814 (minimum 480 Mpa).
11. Low hydrogen smaw electrodes shall be used within 4 hours of opening their sealed containers. Electrodes shall be re-dried no more than one time, and electrodes that have been wet shall not be used.
12. All welding shall be performed in strict adherence to a written welding procedure specification (WPS) submitted by the contractor. All welding parameters shall be within the electrode manufacturer's recommendations.
13. Welding procedures shall be submitted to the owner's testing agency for review before starting fabrication or erection. Copies of the WPS shall be on site and available to all welders and the special inspector.
14. Unless noted otherwise, all welding procedures (WPS) shall be pre-qualified as per AWS D1.1. Annex q of the code gives a sample of a pre-qualified WPS.
15. If non pre-qualified procedures are to be adopted, testing shall be carried our as per AWS D1.1 and the same shall be reported in the WPS
16. All complete joint penetration welds shall be ultrasonically tested upon completion of the connection, except plate less than or equal to 6 mm thick shall be magnetic particle tested. Testing of welds shall be carried out as per AWS D1.1.
17. Reduction in testing may be made in accordance with the building code with approval of the engineer.
18. The contractor shall be responsible for the joint preparations and welding procedures that include, but are not limited to: required root openings, root face dimensions, groove angles, backing bars, copes, surface roughness values, and tapers and transitions of unequal parts.

j) FIREPROOFING STRUCTURAL STEEL

1. All members of the structural frame shall have fire resistance of 2 hours fireproofing. The thickness of the fire-proofing spray shall be applied accordingly.
2. The structural frame consists of columns and girders, beams, trusses, and spandrels having direct connections to the columns or beams and bracing members designed to carry gravity loads.

k) ANCHOR RODS

1. Anchor rods not specified as adhesive anchors shall be of Grade 8.8, unless noted otherwise.
2. Furnish anchor rods prefabricated with matching double heavy hex nuts jammed at the end embedded in concrete.

3. Furnish hardened plate washers, lock washers, and matching heavy hex nuts for securing the base plate to the anchor rods. Hooked anchor rods shall not be used except where noted.
4. A rigid steel template shall be used to locate anchor rods while placing concrete.
5. Anchor rods shall have sufficient length to provide the minimum embedment shown on the drawings, measured from the face of the concrete to the near face of the double nut, with adequate extension as required to receive the base plate with full thread projection for nut installation.
6. Anchor rod installation shall be coordinated with reinforcing and formwork.
7. Levelling nuts shall not be used except after evaluation by the contractor's erection engineer.
8. After base installation, anchor rod nuts shall be installed to a snugtight condition. No heating or bending of the anchor rods is permitted.
9. Holes in the base material shall not be enlarged by burning.
10. Anchor rod shall follow the following dimensional criteria as far as base plates are concerned

ANCHOR ROD	HOLE DIA.	MIN. EDGE / END DIST.	MIN. SPACING / PITCH	EMBEDMENT LENGTH (UNO.)
M20	28	50	75	500
M24	32	60	85	600
M30	40	75	100	750
M36	48	85	125	900
M40	52	100	150	1000

l) COMPOSITE FLOOR SYSTEM

1. Floor slabs shall be constructed to the elevations shown on the structural drawings.
2. The contractor shall include the quantities of the added concrete due to the steel deck deflection.
3. Design camber shown for the steel beams has been calculated based on the deflection of the beam due to the weight of the steel and concrete slab.
4. Minimum slab reinforcing is type T8 - 150 c/c or A252 mesh, unless noted otherwise.
5. Decking sheets shall be continuous over supports

m) SHEAR CONNECTOR STUDS

1. All shear connector studs shall be 19 mm in diameter unless noted otherwise.

2. Shear connector studs shall be automatically end welded in shop or field with equipment recommended by manufacturer of studs. The shear studs shall be able to develop the shear strength as per AISC manual of steel construction.
3. Steel stud material, welding, and inspection shall be in accordance with IS 814 and IS 822.
4. Shear studs shall be placed at a maximum spacing of 300 mm on centre for all beams supporting a steel deck with concrete fill or a cast-in-place concrete slab.
5. This spacing shall also apply when the number of studs is not indicated on the plans.
6. Shear connector layouts are provided in the general detail drawings.
7. Steel deck shop drawings detailing the shear stud placement shall be submitted to the engineer for review before installation.

n) <u>STEEL COMPOSITE DECK / METAL DECKING</u>

1. The steel deck shall be of depth shown on the structural drawings.
2. Unless noted otherwise, gage of deck shall be determined by the contractor based on the span conditions, shoring requirements, construction loads, deflection requirements, and the superimposed loads shown on the drawings, load diagrams, and notes.
3. Minimum sheet thickness is 1 mm.
4. Maximum dead load deflection is 20 mm or L/180.
5. Written verification of conformance for all conditions in the structure shall be submitted for acceptance prior to fabrication.
6. The capacities of the deck shall be certified by the manufacturer.
7. Shop drawings shall be submitted showing deck gage, layout, fastening, stud layout, and closures.
8. If any shoring is to be used, it shall be approved by the general contractor and shall be shown on the shop drawings.
9. Units shall span over four supports, continuous over three or more spans, except where framing does not permit.
10. BS 5950 shall govern the design of all deck units. Steel deck and all of its flashings shall conform to IS 811.
11. The steel shall have received, before being formed, a metal protective coating of zinc conforming to Z185.
12. All welding shall be in accordance with AWS D1.3.
13. Concrete bonding-type units shall be formed with deformations to provide an interlock between the concrete and steel.
14. Unless shown otherwise, units shall be fastened to the steel supports at the ends of the units and at intermediate supports at 300 mm (maximum) on centre with 20-mm-diameter puddle welds; where two units abut, each unit shall be so fastened to the steel supports.
15. The side laps of adjacent units shall be fastened between supports by 40-mm top seam welds at 600 mm on centre or button punched at 600 mm on centre.

16. Deck units shall be fastened to the steel supports at the side boundaries by 20-mm-diameter puddle welds at 300 mm (maximum) on centre. 20>mm-diameter shear studs welded through deck may be used in place of 20>mm-diameter puddle welds.
17. Design and provide flashing and closure plates at wall ends of all units, around columns, and at all perimeter locations requiring closure.
18. Coordinate all closures with elevator, stair, escalator and other architectural details. The deck installation, when complete, shall be ready to receive concrete.
19. Steel deck types shall be Corus Comflor 60 and Comflor 80 or approved equal.
20. Steel decks shall be continuous over supporting beams

o) <u>STEEL ROOF DECK</u>

1. The steel deck shall be of depth shown on the structural drawings.
2. The gage of deck and its connections to the structure shall be determined by the contractor based on the span conditions, deflection requirements, construction loads, diaphragm shears, and the superimposed gravity loads and wind loads shown on the drawings, load diagrams, and notes.
3. Minimum sheet thickness is 1 mm. Maximum deflection under superimposed loads is 12 mm or L/240.
4. The deck and its connections shall provide a minimum allowable diaphragm shear capacity of 7 Kn/m unless noted otherwise on the drawings.
5. Written verification of conformance for all conditions in the structure shall be submitted for acceptance prior to fabrication.
6. The capacities of the deck shall be certified by the manufacturer. Shop drawings shall be submitted showing deck gage, layout, connections, and closures. Roof deck and all of its flashings shall conform to IS 811.
7. The steel shall have received, before being formed, a metal protective coating of zinc conforming to Z185.
8. All welding shall be in accordance with AWS D1.3.
9. Units shall span over four supports, continuous over three or more spans, except where the framing does not permit.
10. Non composite units shall be fastened to the steel supports at the ends of the units and at intermediate supports by a minimum of four connections per 1 meter of width.
11. Where two units abut, each unit shall be so fastened to the steel framing. The side laps of adjacent units shall be fastened between supports by connections at a maximum spacing of 600 mm on centre unless noted otherwise.
12. Deck units shall be connected to the steel supports at the side boundaries at a maximum spacing of 600 mm on center. Connections shall be made with welds, powder actuated fasteners, or pneumatic pins, screws, or mechanical crimping, provided that the contractor presents calculations with current manufacturer test reports demonstrating equivalent values of shear capacity, deck capacity, and deck flexibility.

13. Where steel members are parallel to the deck flutes and at the same elevation of the bottom of the deck, adjust deck layout and weld deck to steel with same welding as required for side boundaries.
14. Steel deck that is to be covered with insulating concrete shall be slotted or perforated to provide a minimum of 1.5 percent uniformly distributed venting.
15. Provide flashing and closure plates at all perimeter locations requiring closure. The deck installation, when complete, shall be ready to receive insulating concrete.

p) STEEL STAIRS, ELEVATORS, AND MISCELLANEOUS METALS

1. The contractor shall design and supply all additional miscellaneous metals that are indicated in the architectural drawings or those metals which are found to be necessary to support the architectural finishes or other building systems.
2. All framing and connections designed by the contractor shall not result in eccentric loads being applied to the primary structure nor lateral loads being applied to the bottom flange of steel beams.
3. The contractor's design shall verify that the connections do not result in adverse local connection stresses occurring within the primary structure.

q) PERMANENT PRESTRESSED ROCK ANCHORS

1. Drilling for anchors will be completed by rotary or pneumatic methods, as per installation pattern, sizes and lengths provided in drawings.
2. Borehole sides shall be adequately protected against side collapse by use of PVC or MS casing.
3. The anchor hole should be perpendicular to the anchor bearing plate. The deviation of the anchor hole entry angle from its inclination as specified the contract documents shall be no greater than $\pm$ 3 degrees.
4. Water tightness test shall be conducted in anchor holes as per IS 12070. If rock permeability is observed to be more than 5 Lugeons, the anchor hole shall be consolidation grouted, redrilled and retested. This procedure shall be repeated until the permeability is less than 5 Lugeons.
5. Ht strands of 12.7mm dia. Or equivalent Tata SSL conforming to LRPC class ii as per IS 14268 will be cut to length of anchor including that required for stressing purpose.
6. Working loads on strands shall not exceed 50% of the characteristic strength of the strands.
7. The strands shall be pre-treated to remove rust/oil, scaling, grease, etc.. Two coats of epoxy formulation shall be applied on the strands. The 2nd coat shall be applied only after allowing the 1st coat to dry for 2-3 hours. Quartz sand shall be sprinkled to roughen the surface. Following epoxy formulation will be used: Araldite: Gy257 (2 parts), Aradur - 140 (1 part)

8. For the strands in free length, a coat of primer (Berger Epilux 610) shall be brush applied. Also a flexible pvc sheath of HDPE, 2mm thick shall be provided over each individual strand. The top and bottom of the HDPE sheating shall be taped at top and bottom.
9. Prepared strands will be grouped together. Spacers shall be used to separate the strands or bars individually or into small groups at regular intervals of 1.5m in fixed length. The strands will be tied with the help of binding wires at the centre of two spacers. A ms guide shoe shall be welded to the bottom of the strands by brazing for lowering the anchor in the bore.
10. Centralizer shall be utilized to support the tendon in the drill hole and position. The tendons so a minimum grout cover of 12mm is achieved. All centralizers shall be designed to permit grout to flow freely around the tendon and up the drill hole. The contractor shall determine the number of centralizers required; however, a minimum of one unit shall be placed within 1m of the bottom of the hole and another at the bond length and free stressing length interface.
11. A PVC grout tube of 25mm diameter will be inserted through all the cable spacers to facilitate grouting. Care shall be taken to ensure that the sheathing, corrosion protection and grout tubes are not damaged during installation.
12. The fixed length of the anchor should be placed in a HDPE corrugated PVC pipe with minimum wall thickness of 0.8mm.
13. The grout shall entirely fill the annular space between the strands and the bore hole wall in the bond length.
14. Grouting will be done with minimum 53 grade OPC cement neat cement grout with non-shrink compound Cebex 100 or equivalent, or with GP2 compound in fixed length, by providing a packer at the top of fixed length or by ensuring with physical measurements that grout does not intrude the free length portion.
15. Three (3) grout cubes (7.5cm x 7.5cm x 7.5cm) will be cast for each day of grouting. One cube will be tested at 7 days while the remaining cubes will be tested at 28 days.
16. Stressing shall not commence until the grout has reached its 28 –day strength.
17. The anchors shall be proof tested to 1.1 times the design load in 5 increments. A multistrand jack system should be utilized for stressing of anchors. The initial increment of 10% of design load will be applied.
18. Elongation should be measured at each of the 5 load increments. The load will be held at the final test load for at least 15 minutes.
19. The anchor can be deemed acceptable upon proof testing if both the below conditions are satisfied:
20. Total elongation exceeds 80% of theoretical elongation of free length.
21. Total elongation is less than the theoretical elongation of free length + 50% theoretical elongation of the fixed length.

22. The load shall then be released and the anchor locked off at desired lock off load with wedges. Wedge holes and wedges shall be free of rust, grout, and dirt. The free length will then be grouted.
23. After cutting off the extra portion of the strand, the anchor head shall be protected with epoxy formulation mentioned above applied uniformly over the thrust plate, bearing plate, and anchor wedges by a concrete block with minimum reinforcement of T8-150 (developed 300mm into waler beam or raft) in either direction.

r) CORROSION PROTECTION OF STRUCTURAL STEEL

1. The environmental exposure condition of all structural steel (uncladded or cladded) exposed to atmosphere (except steel encased in concrete) shall be taken as very severe as per IS 800:2007.
2. The environmental exposure condition of all structural steel within interior of building not exposed to atmosphere shall be taken as moderate as per IS 800:2007.
3. Coating system shall be provided by the contractor based on the above atmospheric conditions and should have a minimum life of 15 years.

s) CAUTION

1. Structural drawings shall be executed on site subject to necessary permission from competent authority.
2. It shall be ensured on site that the construction activity is according to the latest revision of the structural drawings. In case of any confusion or discrepancy, the structural consultant shall be promptly contacted.
3. The responsibility of the structural consultant is limited only to the accuracy of design calculations and structural drawings, and periodic general checking construction activity and test results. The design is be based on the data provided by the Client. The Client shall engage an independent supervision agency to ensure quality control on site.
4. Continuous supervision is not part of the scope of the structural engineer and his inspection cannot guarantee that the work is carried out strictly as per his drawings and generall detail drawings.
5. We shall not guarantee the work of the contractor; we shall not be responsible for the damage to life and property whatsoever resulting from any act by Client, contractor, suppliers or any other agencies during the execution of work.
6. The Client shall also ensure that: no addition and alteration shall be carried out without consulting the structural engineer.
7. Structural members shall not be damaged / tampered with for any reason whatsoever during and after construction.

8. Overloading the structure, changes in the structural system, lack of maintenance, or any act that is detrimental to the safety and stability of the structure as a whole shall be avoided during the lifetime of the structure.

t) DESIGN LOADS

1. Dead loads shall be calculated as per IS 875 latest - part 1.
2. Live loads shall be calculated as per IS 875 latest - part 2.
3. Wind loads shall be calculated as per IS 875 latest - part 3.
4. Earthquake loads shall be calculated as per IS 1893 latest.
5. Load combinations shall be as per IS 875 latest - part 5 and IS 456:2000 latest.

23 DEFINITIONS/ TERMINOLOGY FOR USING STEEL STRUCTURE

Bead
A single run of weld metal deposited on surface.

Butt Weld
A weld in which the weld metal lies substantially within the extension of the planes arc the surfaces on the parts joined.

Crater
A depression left in weld metal where the arc was broken or the flame was removed.

End Crater
A crater at the end of a weld or at the end of a joint.

Fillet Weld
A weld of approximately triangular cross-section joining two surfaces approximately at the right angles to each other in a lap joint, tee joint or corner joint. It is of two types:
(1) Continuous
(2) Intermittent.

Fusion Welding
Any welding process in which the weld is made between metals in a state of fusion without Hammering or pressure.

Non- fusion welding
A term applied to the deposition, by the Oxy-Acetylene process of filler metal on parent metal without fusion of the latter.

Oxy-Acetylene Pressure Welding
Pressure welding in which any Oxy-Acetylene flame is used to make the surface to be united plastic. No filler metal is used.

Run
The metal deposited during one passage of the electrode or blow pipe in the making of a joint.

Weld
A union between two pieces of metal at faces rendered plastic or liquid by heat or pressure, or both, Filler metal may be used to affect the union.

24 STEEL WORK IN SINGLE SECTION FIXED INDEPENDENTLY WITH CONNECTING PLATE

The steel work in single section of R.S. joists, flats, Tees Angles fixed independently with or without connecting plate, is described in these clauses.

Fabrication

The steel sections as specified shall be straightened and cut square to correct lengths and measured with a steel tape. The cut ends exposed to view shall be finished smooth. No two pieces shall be welded or otherwise jointed to make up the required length of member. All straightening and shaping to form, shall be done by pressure. Bending or cutting shall be carried out in such a manner as not to impair the strength of the metal.

Erection

Steel work shall be hoisted and placed in position carefully without any damage to itself and other building work and injury to workmen. Where necessary mechanical appliances such as lifting tackle winch etc. shall be used. The suitability and capacity of all plant and equipment used for erection shall be up to the satisfaction of the Engineer-in-charge.

25 STEEL WORK IN BUILT UP SECTIONS (RIVETED AND BOLTED)

The steel work in built up section (Riveted and bolted) such as trusses, framed work etc. is specified in this clause.

Laying Out

A figure of the steel structure to be fabricated shall be drawn on a level platform to full scale. This may be done in full or in parts, as shown on drawings or as directed by the Engineer-in-Charge. Steel tape shall be used for measurements.

Fabrication

Fabrication shall generally be done as specified in IS 800. In major works or where so specified, shop drawings giving complete information for the fabrication of the component parts of the structure including the location, type, size, length and details or rivets, bolts or welds, shall be prepared in advance of the actual fabrication and approved by the Engineer-in-charge. The drawings shall indicate the shop and field rivets, bolts and welds. The steel members shall be distinctly marked or stencilled with paint with the identification marks as given in the shop drawings.

Great accuracy shall be observed in the fabrication of various members, so that these can be assembled without being unduly packed, strained or forced into position and when built up, shall be true and free from twist, kinks, buckles or open joints. Wooden or metal sheet templates shall be made to correspond to each member, and position of rivet holes shall be marked accurately on them and holes drilled. The templates shall then be laid on the steel members, and holes for riveting and bolting marked on them. The ends of the steel members shall also be marked for cutting as per required dimensions. The base of steel columns and the positions of anchor bolts shall be carefully set out at the required location.

The steel section shall be straight or to be straightened or flattened by pressure unless required to be of curvilinear form and shall free from twists. These shall be cut square either by shearing or sawing to correct length and measured by steel tape. No tow pieces shall be welded or joined to make up for the required length of member.

Making Holes

Holes through more than one thickness of materials for members, such as compound stanchion and girder flanges shall, where possible, be drilled after the members are

Steel Work

Assembled and tightly clamped or bolted together. Punching may be permitted before assembly, provided the holes are punched 3mm less in diameter than the required size and reamed after assembly to the full diameter. The thickness of material punched shall be not greater than 16 mm.

Rivet Holes

The diameter for rivets and black bolts holes shall be taken as the nominal diameter of a rivet/ black bolts plus 1.5 mm for rivets/ bolts of nominal diameter less than or equal to 25 mm" and 2.0 mm for rivets of nominal diameter exceeding 25 mm, unless specified otherwise. Holes for turned and fitted bolts shall be drilled or reamed large by 0.2 to 8 mm depending upon the dia. of bolts. Holes shall have their axis perpendicular to the surface bored through. The drilling or reaming shall be free from burrs, and the holes shall be clean and accurate. Holes for rivets and bolts shall not be formed by gas cutting process. Holes for counter sunk bolts shall be made in such a manner that their heads sit flush with the surface after fixing.

Assembly : Before making holes in individual members, for fabrication and steel work intended to be riveted or bolted together shall be assembled and clamped properly and tightly so as to ensure close abutting, or lapping of the surfaces of the different members. All stiffeners shall be fixed (or placed) tightly both at top and bottom without being drawn or caulked. The abutting joints shall be cut or dressed true and straight, and fitted close together.

Web plates of girders, which have no cover flange plates, shall have their ends flush with the tops of angles unless otherwise required. The web plate when spliced, shall have clearance of not more than 5mm. The erection clearance of cleated ends of members connecting steel to steel shall preferably be not greater than 1.5 mm. The erection clearance at the ends of beams without web cleats shall not be more than 3 mm at each end but where for practical reasons, greater clearance is necessary, seating designed suitably shall be provided. Column splices and butt joints of struts and compression members requiring contact for stress transmission shall be accurately, machined and close butted over the whole section. In column caps and bases, the ends of shafts together with the attached gussets, angles, channels etc. after riveting together shall be accurately machined so that the parts connected, butt against each other over the entire surfaces of contact. Connecting angles or channels shall be fabricated and placed in position with great accuracy so that they are not unduly reduced in thickness by machining. The ends of all bearing stiffeners shall be machined or grounded to fit tightly both at top and bottom.

Riveting : Rivets shall be used, where slip under load has to be avoided.

Preliminaries before Rivetings:- Members to be riveted shall have all parts firmly placed and held together before and during riveting, and special care shall be taken in this respect for all single riveted connections. For multiple riveted connections, a service bolt shall be provided in every third or fourth hole.

Process of Riveting

The riveting shall be carried out by using machines of the steady pressure type. However, where such facilities are not available hand riveting may be permitted by the Engineer-in-charge. The rivets shall be heated red hot, care being taken to control the temperature of heating so as not to burn the steel. Rivets of diameter less than10mm may be driven cold. Rivets shall be finished neat with heads full and of equal size. The heads shall be central on shanks and shall grip the assembled members firmly.

All loose, burnt, or badly formed rivets with eccentric or deficient heads shall be cut out and replaced. In cutting out rivets, care shall be taken so as not to injure the assembled members. Caulking and recapping shall not be permitted. For testing rivets, a hammer weighing approx. 0.25 kg shall be used and both heads of the rivet (Specially the machine head) shall be tapped. When so tested, the rivets shall not give a hollow sound and a jar where so specified, other tests shall be carried out to ensure the soundness of rivets. All rivets heads shall be painted with approved steel primer paint within a week of their fixing.

Bolting

The nominal length of the bolt shall be the distance from the underside of the head to the further end of the shank. The nominal diameter of the bolt shall be the diameter at the shank above the screwed threads. Bolts, nuts and washers shall be thoroughly cleaned and dipped in double boiled linseed oil, before use. All bolts heads and nuts shall be hexagonal unless specified otherwise. The screwed threads shall conform to IS 1363 and the threaded surface shall not be tapered. The bolts shall be of such length as to project at least two clear threads beyond the nuts when fixed in position, and these shall fit in the holes without any shake. The nuts shall fit in the threaded ends of bolts properly. Where necessary, washers shall be tapered or otherwise suitably shaped to give the heads and nuts of bolts a satisfactory bearing. The threaded portion of each bolt shall project through the nut at least two thread. In all cases where the full bearing area of the bolt is to be developed, the bolt shall be provided with a washer of sufficient thickness under the nuts to avoid any threaded portion of the bolt being within the thickness of the parts bolted together. Where there is a risk of the nuts being removed or becoming loose due to vibrations or reversal of stresses, these shall be secured from slackening by the use of lock nut, spring washers as directed by the Engineer-in-charge.

Erection

Steel members shall be hoisted and erected in position carefully, without any damage to itself, other structures and equipment and injury to workmen. The method of hoisting and erection proposed to be adopted by the contractor shall be got approved from the Engineer-in-charge in advance. The contractor however shall be fully responsible for the work being carried out in a safe and proper manner without unduly stressing the various members and proper equipment such as derricks, lifting tackles, winches, ropes etc. shall be used.

The work of erection may be done in suitable units as may be directed by the Engineer-incharge. Fabricated members shall be lifted at such points so as to avoid deformation or excessive stress in members. The structure or part of it placed in position shall be secured against over-turning or collapse by suitable means. During execution, the steel members shall be securely bolted or otherwise fastened when necessary temporarily braced to provide for all loads including those due to erection equipments and its Operation to be carried safely by structure during erection. The steel members shall be placed in proper position as per approved drawing, final riveting or permanent bolting shall be done only after proper alignment has been checked and confirmed.

Trusses shall be lifted only at nodes. The trusses above 10 m in span shall not be lifted by slinging at two mid points of rafters, which shall be temporary braced by a wooden member of a suitable section. After the trusses are placed in position, purlins and wind bracings shall be fixed as soon as possible.

The end of the truss which faces the prevailing winds shall be fixed with holding down bolts, and the other end kept free to move. In case of trusses of spans upto 10m the free end of the truss

shall be laid on lead sheet or steel plate as per design, and the holes for holding down bolts shall be made in the form of oblong slots so as to permit the free movements of the truss end. For larger spans the truss shall be provided with proper bearing as per design.

Columns and stanchions shall be erected truly vertical with the necessary cross bracing etc. and the base shall be properly fixed with the foundation concrete by means of anchor bolts etc. as per drawing.

Anchor bolts to be placed in the concrete foundation should be held in position with a wooden template. At the time of concreting anchor bolt locations shall be provided with suitable timber mould or pipe sleeve to allow for adjustment which shall be removed after initial setting of concrete. The spaces left around anchor bolts shall be linked to a stopping channel in the concrete leading to the side of the pedestal and on the underside of the base plate to allow the spaces being grouted up after the base plate is fixed in the position along with the column footing. Grouting shall be of cement mortar 1:3 (1 cement: 3 coarse sand) or as specified.

Bedding of Column, Stanchions etc.:-

Bedding shall not be carried out until the steel work has been finally levelled, plumbed and connected together. The stanchion shall be supported on steel wedges and adjusted to make the column plumb. For multi-storeyed buildings, the bedding shall not be done until sufficient number of bottom lengths of stanchions have been properly lined, levelled and plumbed and sufficient floor beams are fixed in position. The base plates shall be wedged clear of the bases by M.S. wedges and adjusted where necessary to plumb the columns. The gaps under the base plate may be made upto 25 mm which shall be pressure grouted with cement grouts. With small columns, if permitted by the Engineer-in-charge, the column base shall be floated on a thick cement grout on the concrete pedestal. The anchor bolt holes in the base plate may be made about 10 to 15 mm larger than the bolts. In such cases suitable washers shall be provided.

26 SPECIFICATIONS FOR STRUCTURAL FABRICATION AND ERECTION:

GENERALL:

All dimensions are in mm and levels in meters. Written dimensions shall be followed. No dimension shall be scaled from the drawing. If in doubt, please ask the concerned project in charge for clarifications.

Structures are fabricated in accordance with relevant Indian/ International standard codes of practice.

Material:

i. Structural steel and other related materials for construction shall confirm to Annexure A.
ii. All test certificates confirming to IS Codes which is going to be used for the construction of building structure has to be submitted to CLIENT for every consignment.
iii. Due to non-availability of specified materials, suitable substitutions may be provided with consent of the CLIENT .Such substitution shall be incorporated in the "As-built" drawings.
iv. Rolling and cutting tolerances shall be as per IS: 1852-1985.
v. Cover electrodes for arc welding shall conform to IS: 814 - 2004/ Equivalent International standard.
vi. Raw materials shall be straightened before marking and cutting if required.

vii. All hexagonal bolts & nuts should be Chromium Coated and it should be rotate freely and shall confirm to IS: 1363-2002 and IS 1364-2004 (for precision and semi-precision hexagonal bolts). Washer shall confirm to IS 2016-1967.

viii. Crane Rails shall confirm to IS: 3443-1980.

Connections:

i. In general, all welding shall conform to IS: 9595-1991/ Equivalent International standard and welding design to IS: 816-1969/ Equivalent International standard.

ii. All fillet welds shall be 6 mm continuous unless otherwise specified.

iii. Minimum size of fillet welds based on thickness of connected members shall be as given below if details are not given in the drawing :

S. No	Description				
1	Thickness of Plate in mm	6-20	21-30	31-50	51 & above
2	Minimum size of Fillet weld	6-8	8-10	10-12	12-16

a) Bolts shall be provided with washer plates of thickness equal to half the thickness of base plate or 10 mm whichever is more. Washer plates on the column base plate shall be site welded after alignment of column. Holes for bolted connection should match well to permit easy entry of bolts. Gross mismatch of holes shall be avoided.

b) Fillet weld terminating at the sides or ends of parts shall be returned around the corners for a distance of not less than 25 mm.

c) All shop splices shall be made by means of full strength full penetration butt welds unless otherwise specified. Not more than one splice shall be permitted per member.

d) Shop butt joints in flanges and webs shall be staggered type in assembly.

e) Back strips shall be provided in case of butt joints where welding with sealing run is not possible on account of inaccessibility. Ends of butt welds are to be continued beyond the limits on run-on and run-off plates.

f) Butt joints are to be welded from both sides irrespective of edge preparation except when back strips are used. Back-gouging shall be done pneumatically or by proper grinding method.

g) Machining of contact surfaces of column base, end of column shaft, cap plates and bearing stiffeners shall be done wherever specified in the drawing. At other places maximum surface unevenness on contact surface of base plate, cap plate shall not exceed 0.5 mm. Maximum gap between bearing end of column shaft and base plate at any place shall not exceed 1 mm. If this is achieved by cold sawing and grinding, machining of column end need not be done.

h) Chequered plate platforms exposed to weather shall have 25 mm diameter holes drilled at 450mm C/C to drain rain water.

i) Drain holes shall be provided in the stiffeners of base plates of columns to drain off rain water, wherever the stiffeners form an enclosed space in the column base.

j) Members fabricated in pieces due to limitations of transport shall be control assembled at shop in order to ensure true length, fitment and alignment. Where control assembly is not possible matching details and holes shall be marked with template. Control assembly part assemblies shall be given matching identity marks. In column wherever such type of joints are reqd. it should be provided 1000 mm above the floor level.
k) Shop splices shall not be spaced less than 6 mtrs.
l) Prior approval shall be taken for any splice not indicated in the drawing.
m) Full scale layout is recommended, before cutting of material. Size and length specified in drawing BOM are tentative and are basically released for raw material indenting purpose.
n) All inclined dimensions and gusset sizes shall be checked during actual shop layout as per drawing.
o) Fabricated structures shall conform to tolerance as specified in IS: 7215 - 1974/ Equivalent International standard.

Inspection of connections:

All butt welds in structural members like columns, floor and framing beams, crane girders and bases shall be tested as follows:

a) 10 % Dye Penetration test on root run and wherever in doubt during the process.
b) 100 % Visual examination.
c) 100% Ultrasonic test (For important Butt Welds Only).

27 FABRICATION OF STEEL STRUCTURES:

General:

This specification shall apply to fabrication and supply of all building structures pertaining to structural steel works complete in all respect as per specification.

Fabrication and Painting:

The Contractor shall carry out, under fabrication and shop painting Connection design, Preparation of drawings, Getting Approval, Procurement of Steel (Grade E250/E350), Primer, Paint, Permanent fasteners, Anchor Bolts and hardware along with all accessories. Fabrication of Structural Steel including Surface preparation with Shot blasting & painting, Packing, loading, transportation and supply at site.

i. Preparation of Connection drawing mentioning the bolted joints, arrangement of bolts and specification of bolts, nuts etc. (Specifying Clearly shop and site bolts).

ii. Procurement and supply of all erectable consumables like bolts, nuts, washers, shims and packs etc., including allowance for spares and wastages.

iii. Cold straightening of sections and plates, whenever they are bent and kinks.

iv. Carry out the controlled assembly of steel structural components at site, wherever required or as directed by the Client.

v. Re-fabrication of parts, damaged beyond repair during transport & handling or incorrectly fabricated, and fabrication of parts omitted during fabrication by oversight or subsequently found necessary.

vi. Making arrangements for and providing all facilities wherever applicable for conducting ultrasonic testing on butt welds, getting the test conducted by reputed testing laboratories, making available test films/ graphs, reports and interpretation at site or erection site.

vii. Preparation of steel structural surfaces with shot blasting for painting at fabrication yard as specified in the design drawings/specification.

FABRICATION:

i. Fabrication will be done only as per fabrication drawings/sketches etc. supplied by The Client.

ii. All edge preparation for welding shall conform to IS: 9595-1980.

iii. All the items are to be cut as per requirements of the drawing. If joints are to be provided in any item, in order to meet requirements of size and shape, cutting plan showing locations of joints shall be prepared for consideration of The Client. Joints provided shall be incorporated in "As-built" drawings.

iv. Fabrication of all structural steelwork shall be in accordance with IS: 800-1984 and in conformity with various clauses of specification.

v. Fabrication of structures shall be preferably be taken as per the sequence of erection.

vi. Surface, wherever machining is specified, shall be either planed or milled or ground to ensure maximum contact. Standard of acceptance for machined surfaces, wherever specified by designer, (eg. In column cap plates, base plates, and columns shafts etc.) Shall be given as per relevant IS codes. Maximum surface unevenness on bearing surface of cap/base plates shall not be exceeding 0.5 mm.

vii. Wherever perfect matching of parts is required at site, member shall be shop assembled before dispatch. Parts not completely assembled in the fabrication yard shall be secured, to the extent possible, to prevent damage during dispatch.

viii. No hole shall be made by gas cutting process.

ix. The fabricator shall carry out the controlled assembly of the following structures and units at site before dispatch to erection site.

x. The welding and welded work shall conform to IS: 816-1969. The extent of quality control in respect of welds in important structural elements such as crane girders, girders, floor and framing beams, column shafts including traverses and bases etc., shall be as follows:-

a. 100 % Dye Penetration test on root run and wherever in doubt during the process

b. 100% visual examination.
c. 100% ultrasonic test (for important butt welds only).

xi. The Client/ Client's engineer reserves the right to demand X-ray or other tests of welds wherever he considers necessary and the Contractor shall be prepared to carry out tests as directed by the Client/ Client's engineer. The Cost of NDT of welds as per the specification shall be included in quoted price.

xii. For other structures in addition to 100% visual check and measurement of external dimension by appropriate gauges, selective examination of welds by drilling, ultrasonic / radiographic / magnetic particles tests shall be done if necessary.

xiii. Standard of acceptance for weld defects is indicated below:

xiv. For metal thickness up to 10mm under cuts shall not be more than 0.5mm. For metal thickness more than 10mm, under cuts shall not be more than 1mm.

xv. Incomplete weld, molten metal flow, pits and cracks shall not be allowed.

xvi. Following weld defects detected by ultrasonic method of tests are permissible:

xvii. For joints welded from both sides, incomplete penetration shall neither be more than 50mm in length in one stretch nor the aggregate length be more than 200mm per meter length of joint. Thickness of incomplete penetration shall not be more than 5% of the thickness of the parent metal or 2mm, whichever is greater.

xviii. Where joint welding from one side without backing strip is permitted, thickness of incomplete penetration shall neither exceed 15% of the thickness of parent metal nor 3mm at the root.

xix. Slag inclusion located along the length of the weld and measured in a chain or separately shall not exceed 200mm per meter length of the weld, subjected to the following:-

xx. At any cross-section, aggregate thickness of incomplete penetration, slag inclusion and pores located separately as a chain shall not exceed:

a. 10% of the metal thickness or 2mm whichever is greater when welding is done from both sides.
b. 15% of the metal thickness or 3mm whichever is greater when welding is permitted from one side and without backing strip. In case any weld is found defective by radiographic examination further equivalent adjacent lengths or welds shall be tested by radiographic examination.

xxi. In case of detection of defects in welds, the rectification of the same shall be done as follows:-

xxii. All craters in the weld and breaks in the weld and breaks in the weld run shall be thoroughly filled with the weld.

xxiii. Undercuts, beyond acceptable limits, shall be repaired with dressing so as to provide smooth penetration. Porosity, slag inclusion etc. exceeding permissible limits shall be rectified by removing the lengths of weld at the location of such defects plus 10mm from both ends of defective welds, and shall be re-welded.

xxiv. The Contractor shall make all necessary arrangements for stage inspection by Client's engineer/inspector during the fabrication at site and incorporate all on-the-spot instructions/changes conveyed in writing to the Contractor. Members wrongly fabricated shall be reported to inspector and shall be made good as directed. Minor misfits which can be remedied by a moderate use of drift pins, and moderate amount of reaming and slight chipping may be corrected in that manner, if in the opinion of the client's engineer/inspector the strength or the appearance of the structure will not be affected adversely. In the event, the Client's engineer/inspector directs otherwise, the items will be rejected and completely new piece shall be fabricated. The cost of correcting errors shall be to the account of the Contractor. No field torch repairs shall be carried out unless approved by the engineer/inspector.

28 Tolerance of Workmanship:

The permissible tolerance in workmanship shall be as per IS: 7215-1974.

Programme:

a) All programme on fabrication and dispatch shall match with the sequence of erection of different structural components and different buildings/units, of the projects as per planning or mutual agreement between the client and the Contractor.

b) The Client may change or alter the detailed working programme for the sequence of work and for the fabrication of components of structures, within the framework of the agreed schedule, which will be binding on the Contractor.

c) If due to design or other stipulations in the bid or requirements at site, a particular sequence of overall construction has to be followed due to which certain interruptions to any one or more items of work are inherent, no claims for such interruption will be admissible.

Drawings:

a) Three (3) sets of drawings and soft copy in Auto Cad will be supplied to Contractor by The Client.

b) Correctness of all details like cutting length of individual items, gusset/cleat size, matching holes, dimension of individual items, matching of marking, bill of materials, bolt lists etc, shall be the responsibility of the Contractor .

Contractor's Responsibility:

The Contractor shall take the prior approval from the client regarding subletting the work fully or partly.

Shifting of Fabricated Materials:

The Contractor is solely responsible for any loss or damage during transit of any of the fabricated members, and as such proper precautions shall be taken to guard against such mishaps. For all such important structures, match marking shall be given at the control assembly stage in the shop floor and such match marking shall be made clearly visible while assembling the structures at site. Centre lines of column flanges and both sides of web shall be punched, preferably at top and bottom to facilitate alignment after erection. As built drawing shall be prepared after fabrication is complete to indicate additions/alternations made during the process of fabrication. Each despatchable structure shall bear mark no. along with reference drawing number at two locations.(eg. On flange and bottom of base plate of column).

Setting Out:

i. The Contractor shall be responsible for checking the alignment and levels of foundations, correctness of foundations, centers of anchor bolts etc., well in advance of starting erection work and shall be responsible for any consequence for non-compliance thereof. Discrepancies, if any shall immediately be brought to the notice of the client. Any mistake subsequently found in alignment and levels of the structural steel work due to non-verification of foundation shall be rectified at Contractor's expense.

ii. One set of reference axes and one bench mark level will be furnished to the Contractor. These shall be used for setting out of structures. Maintenance of such bench mark level shall be the responsibility of the Contractor.

iii. The Contractor at his own expenses shall provide measuring instruments (Total Station, Dumpy Level) for setting out, leveling and alignment steel work.

Staging:

Any staging necessary for the preassembly work of structures shall be provided by the Contractor at his own expense.

Rules & Regulations of Safety, Electricity Boards, Factory etc.:

The Contractor shall at all times comply with all relevant factory acts, electricity rules, safety regulations etc. as per statutory requirement of Central/State Government.

Deviations:

Should the Contractor wish to deviate from any specification or details showed on The Client's approved drawings and/or Technical Specifications, he shall obtain The Client's written permission before proceeding with the deviations in proper format.

Measurement:

i. Measurement for structural steel work shall be made on the calculated weights of steel work as determined from the dimensions given on the approved drawings or any approved amendments there to. In the case of mild steel plates the calculated weight shall be based on 78.5 kg per sq-m of metal 1 cm thick and in the case of mild steel standard sections and rods, the weights shall be calculated on the basis of weight per meter run specified in the relevant Indian standards.

ii. The weights of all plates and sheets shall be calculated using the actual dimensions shown in the drawings with deductions for skew units and openings irrespective of their size. However, no deductions shall be made for skew cuts for gussets, rolled sections and holes for bolts. The weight for gusset shall be calculated from its overall dimensions.

iii. No additional weight for weld metal deposited, bolts (permanent or erection bolt), nuts, washers, etc. shall be allowed in measurements. Cost of bolts, washers, nuts electrodes,

gases, etc. as required for the work shall be deemed to be included in the quoted rates.

iv. Oiling, painting, temporary cleats, marking, packing and delivering to site shall be included in the scope of work.

v. The weights to which the rates shall be applicable shall be as shown on the approved drawings /material lists and no allowance for wastage shall be permitted. Suitable cutting diagrams of components shall be prepared in order to minimize consumption of steel.

29 SURFACE PREPARATION AND PAINTING OF STEEL STRUCTURES:

GENERALL

i. This specification is intended to cover the general requirements for surface preparation and painting of steel structural work. Reference may also be made to IS: 8629-1977 (parts I to III)

ii. Code of Practice for Protection of Iron and Steel Structures from atmospheric corrosion.

iii. While this gives a general indication of the surface preparation and painting requirements, special cases may arise which have to be dealt with individually on the merits of each case.

The Contractor shall carry out the painting of structures fabricated by them with suitable paints. The schedule of painting shall be 1 coats of red oxide and 2 coats of enamel paint. Blast cleaning shall be done by shot blasting as per Swedish standard. Grade Sa-2 ½-- this involves very thorough blast cleaning. Mill scale, rust and foreign matter shall be removed to the extent that the only traces remaining are slight stains in the form of spots or strips. Finally the surface is cleaned with a vacuum cleaner, clean dry compressed air or a clean brush. It shall then correspond in appearance to the prints designated as Sa-2 ½.

PAINTS AND PAINTING:

General:

i. Areas which become inaccessible after assembly shall be painted before assembly after cleaning the surfaces as specified.

ii. Portion of structures to be encased or embedded in concrete shall not be painted, but shall be coated with cement slurry, on completion of fabrication.

iii. Wherever shop primer is damaged, the surface shall be thoroughly cleaned and the damaged portion shall be painted with the same primer.

iv. Application of paint shall be by spraying as per IS: 486-1983 and IS: 487-1985. painting shall not be done when the temperature is less than 5°C or more than 45°C and relative humidity is more than 85% unless manufacturer's recommendations permit. Also painting shall not be done in frosty or foggy weather. During application, paint agitation must be provided where such agitation is recommended by the manufacturer.

Painting of steel structures

a) If more than 50% of the painted surface of an item requires repair, the entire item shall be mechanically cleaned and new primer coats shall be applied followed by finishing coats as per painting specification.

b) Primer paint shall be applied not later than 2-3 hours after preparation of surface, unless specified otherwise.

c) The finishing paint as specified shall be of approved colour and quality.

d) Edges, corners, crevices, depressions, joints and welds shall receive special attention to ensure that they receive painting coats of the required thickness.

e) Surfaces which cannot be painted but require protection shall be given a coat of rust-inhibitive grease according to IS: 958-1975.

30 ERECTION OF STEEL

General

In addition to provision of erection, transport and handling of equipment, the specification of work in this scenario shall include supply of tools and tackles, consumables, materials, labour and supervision, and shall cover the following:-

a) Storing and stacking at site all fabricated structural components/ units/ assemblies till the time of erection.

b) Transporting structures from storage yard to site including multiple handling if required.

c) All minor rectification/ modifications such as:

i. Removal of bends, kinks and twists etc. for parts damaged during transport and handling.
ii. Other rectification works such as:
iii. Plugs welding and re-drilling of holes which do not register and which cannot be reamed or used for next higher size bolt.
iv. Drilling of holes, which are either not, drilled at all or are drilled in incorrect position during fabrication.
v. Fabrication of minor items/ missing items or such important items as directed by the engineer.
vi. Verification in the field of the position of the embedded anchor bolts and inserts with respect to line and level, installed by others based on bench mark/ reference co-ordinates to be furnished by the engineer.
vii. Assembly at site of steel structural components wherever required including temporary supports and staging.
viii. Rectification at site damaged portions of shop paint by cleaning and touch up paints.
ix. Erection of structures including connections by bolts/welding (Rail works).
x. Alignment of all structures true to line, level, plumb and dimensions within specified limits of tolerances as per drawing and specifications.
xi. Supply of labour in sufficient numbers, where necessary, as directed by The Client.
xii. Conducting preliminary acceptance & final acceptance tests and rectification of structures wherever required as per preliminary & final acceptance report.
xiii. Preparation of sketches/ drawings to suit availability of material, convenience of fabrication, transportation and erection and changes during fabrication and erection. All such works are subject to approval of The Client.

xiv. The members of the structures which are received under knock-down condition shall be assembled and welded on ground at site prior to erection.

Erection Drawings:

The approved erection drawings and any approved arrangement drawings, specifications or instructions accompanying them shall be followed in erecting the structures.

Storing and Handling:

i. Before starting erection, the program and sequence of work shall be followed as approved or mutually agreed by The Client.

ii. The fabricated materials on receipt at site shall be carefully unloaded, examined for defects, checked, sorted out for each building and stacked securely on skids above level ground which shall be kept clean and properly drained. Girders and beams shall be placed upright and stored. Long members such as columns and chord members shall be supported on skids placed close enough to prevent damage from deflections.

iii. The fabricated material shall be verified with respect to markings on the marking plan or shipping list which shall be supplied by the Contractor.

iv. Any material found damaged or defective shall be stacked separately and the damaged or defective portions shall be painted in distinct color for identification. Such materials shall be dealt with as instructed by The Client.

v. The handling and storing of component parts of a structure shall involve the use of methods and appliances not likely to produce injury by twisting, bending or otherwise deforming the structures. No member slightly bent or twisted shall be put in place until the defects are corrected. Members severely damaged in handling shall be rejected.

Defects in Materials and Rectification:

All members shall be straight unless required to be curvilinear for and shall be free from twists. Only cold straightening shall be permitted.

During assembly and before erecting the units to position, the Contractor shall compare the structures with the drawings to ensure that there are no fabrication errors or omissions. Should any defects or omissions be found, the same shall be brought to the notice of CLIENT, who will issue necessary instructions for its rectification.

Assembly and Erection:

i. Before starting erection, the Contractor shall submit to follow and number and types of equipments and temporary work proposed to use for erection.

ii. The approval of The Client shall not be considered as relieving the Contractor for the loads for which the erection equipment and temporary work will be called upon to carry and support. Adequate allowances and provision shall be made for lateral forces and wind forces.

iii. If in the opinion of The Client, the tools, tackles, plant and equipment, instruments, apparatus, etc. arranged by the Contractor are not sufficient or are inadequate for the fulfillment of contractual obligations of the Contractor within the stipulated period, The Client shall have the right to order the Contractor and the Contractor shall comply with order to bring/ arrange such additional tools, tackles, plant and equipment, instruments, apparatus etc. to the site and arrange the same to complete the work in time. All charges in connection thereof shall be borne by the Contractor.

Proper consideration shall be given to the following items during erection:

a) Frames of the building to be true to plumb.

b) Temporary guying and bracing shall be used to align the frames during erection, if required. All temporary guying and bracing shall be in Contractor Scope.

c) Temporary bracing may be required to sustain forces due to erection load and equipment. Erected parts of the structures shall be stable during all stages of erection. The stability of the structure subjected to action of wind, dead weight and erection forces shall be achieved by installing permanent and temporary bracing.

d) Erection member shall be held securely in place by bolts to take care of dead loads, erection loads, wind loads.

e) Provision of free expansion and contraction wherever provided.

f) No final bolting of joints shall be done until the structures are fully aligned.

g) Erection tools and machinery shall be of suitable capacity for handling the materials furnished and must be in safe Operating conditions at all times to avoid dangers to materials and personnel.

h) In positioning beams, columns and other steel members, the use of steel sledge shall not be permitted.

i) The Contractor shall report all failures of the fabricated steel to fit together properly to CLIENT and shall obtain approval prior to taking corrective measures.

j) Steel members shall not be allowed to fall or be subjected to shock or impact due to other members being swung into position or for any other causes.

k) Contractor should provide Cherry Packer /Man Lifter for Fixing and Tightening the Bolts & Nuts.

l) Torque Value for tightening of Bolts & Nuts should be incorporated.

Other vital points to be taken care off during erection

i. The erection shall be carried out according to the best modern practices and as laid down in IS: 800-1984 and other relevant standards referred to therein and this erection specification together with erection drawings.
ii. The Contractor shall be carry out Connection design, manufacture, erection and provide false work, staging, temporary supports etc. wherever required for safe and accurate erection of structural steelwork and shall be fully responsible for the adequacy of the same.
iii. The Contractor shall provide adequate supervision by competent personal at all stages of the work and examine each portion of the work for accuracy before commencing the erection of the next structural members.
iv. The Contractor shall also provide facilities such as adequate temporary access ladders,

gangways, tools and tackles, instruments etc., for inspection at any stage during erection.

v. Instrumental checking for correctness of initial setting out of structures, and adjustment of alignment shall be carried out in sequence and at different stages as determined by design. The final leveling and alignment shall be carried out immediately after completion of each section of a building or when called for by The Client.

vi. All structural members shall be erected with erection mark in the same relative position as shown in the appropriate erection and shop drawings.

Field Connection:

a) The number of washer on permanent bolts shall not be more than two (and not less than one) for the nuts and one for bolt head.
b) Wooden rams or mallets shall be used in forcing members into position, in order to protect the metal from injury and shock.
c) The permanent bolts shall be tightened to the maximum limit. The threaded portion of each bolt shall project through the nut by at least 4-5 thread.
d) Spring washers or locknuts shall be provided as specified in the design/ shop drawings.
e) All field assembly and bolting shall be executed in accordance with the requirement of shop fabrication.

BEDDING AND GROUTING

i. Base plates shall be set to elevations shown on the drawings, supported and aligned using steel wedges and shims or other approved methods. The supply of wedges and shims and materials for alignment shall be the responsibility of the Contractor as part of this work at no extra cost. Plates shall be leveled, properly positioned and anchor bolts tightened. The Contractor shall provide the packing plate at least four corner of the base plate.

ii. The bedding/ grouting shall not be carried out until a sufficient number of columns have been aligned, leveled, plumbed and sufficient girders, beams, trusses and bracings are in position to the satisfaction of The Client.

iii. The Contractor shall inform The Client when the base plates are ready for grouting and shall co-ordinate with others regarding grouting schedule. The Contractor is responsible for the final vertical and horizontal alignment of all base plates.

Erection of Miscellaneous Structures:

a) Unless otherwise specified, the crane rail joints shall be butt-jointed (either by Thermit or fusion welding) or by fish plate as per specification/ drawings.
b) The joint shall be free from kinks, twists etc. and shall be ground properly after bolting.
c) Method of securing the crane rail to the crane gantry, alignment and expansion joints, if any, shall be as indicated in the approved drawings.

31 <u>Preliminary Acceptance:</u>

After completing the erection of a unit or portion thereof, the Contractor shall give a notice in writing stating that the job is complete in all respects and ready for preliminary acceptance. The job shall be jointly inspected visually by representatives of Contractor and The Client. All observed defects and omissions as per drawings and specifications shall be noted down. If the defects are not major in the opinion of The Client / The Client's representatives, the Contractor will be issued a preliminary acceptance certificate mentioning the defects, deficiencies and

omissions which shall be made good by the Contractor within a period of 2 weeks.

32 Final Acceptance:

a) Before commencement of inspection for final acceptance of the unit, the Contractor shall make available two complete sets of all modification drawings, sketches (if any) prepared by him during execution of work.

b) The Contractor shall make good all defects, deficiencies and omissions noted down during preliminary acceptance and shall inform in advance the Client / The Client's representatives for conducting inspection for final acceptance. Final acceptance certificates will be issued by the Client / The Client's representative only after all defects / deficiencies / omissions noted under preliminary acceptance have been certified.

Acceptance of Work:

1. Acceptance of erected steel structures shall be either after completion of erection of the whole building or in blocks.

2. Intermediate acceptance certificates will be given in the following areas:-

i) Any steel work or part thereof embedded in concrete.

ii) Steel structures, which are to be covered in the process of carrying further work.

3. The following documents shall be prepared and produced by the Contractor at the time of acceptance of erected steel structures:-

i) Documents showing approved deviations made during execution of erection work.

ii) Documents showing acceptance of embedded structural steel work.

iii) Certificates / documents on control checking and testing of materials (if any) and welds.

iv) Data and results of geodetic measurements while checking the erection of structures.

33 FUSION-BONDED EPOXY COATING

i. MATERIAL:

- To protect reinforcing steel against corrosion, the coating shall be provide a continuous film that will resist penetration by salt ions, resist the action of osmosis, adhere to and expand / contract with the steel substrate, resist breakdown from weathering and exposure and be flexible and durable enough for handling. Once the coating is cured, the coating shall not tend to soften with higher temperatures.

- The FBE coating shall be done confirming to IS code 13620:1993. Patch up materials shall be procured in sealed containers. PVC coated 18G binding wire shall be used for tieing reinforcement steel.

- The epoxy coating shall achieve its beneficial properties as a result of a heat catalyzed chemical reaction. The dry powder shall be produced by combining organic epoxy resins with appropriate curing agents, fillers, pigments flow control agents. When heated, the powder shall melt and its constituent shall react to form complex cross-linked polymers.
- The fusion-bonded epoxy coatings used for steel reinforcement shall not contain appreciable solvents or other environmentally hazardous substances. Also systems used to apply the coating shall be very efficient resulting in very little material loss to the atmosphere or waste disposal.

ii. **MANUFACTURING PROCESS:** The application of fusion-bonded epoxy coating to steel reinforcement involves four major process steps:

a) **Surface preparation**
b) **Heating**
c) **Powder application**
d) **Cure**

In coating plants, rebar shall be first coated in straight lengths and then fabricated (i.e., cut to length and bent to shape).

a) **SURFACE PREPARATION:** The objective of surface preparation shall be to assure that maximum adhesion will develop at the interface between the steel and the coating. Rebars shall be blast-cleaned using abrasive grit to a near white metal finish. The process shall clean the steel of contaminants, mill scale and rust. It shall also roughen the surface to give it a textured anchor profile. The surface roughness shall key the coating to the steel and shall provide mechanical anchorage. Texturing the surface shall also facilitate adhesion by increasing the exposed surface area of the steel and shall provide more opportunity for chemical bonding of the coating. Chemical pre-treatments shall be used to supplement last cleaning and facilitate surface preparation.

b) **HEATING:** After the bars have been blast-cleaned, they shall be heated to approximately 450 degrees F. This shall be usually accomplished using electrical induction heaters. The gas-fired heating shall be used in some cases.

c) **POWDER APPLICATION:** The heated steel shall be passed through a powder spray booth where the dry epoxy powder shall be emitted from a number of spray nozzles. As the powder leaves the spray gun, an electrical charge shall be imparted to the particles. These electrically charged particles should be attracted to the grounded steel surface providing even coating coverage. The dry powder

shall hit the hot steel & shall melt and flow into the anchor profile (i.e., the microscopic peaks and the valleys on the surface) and shall conform to the ribs and deformations of the bar. The heat shall initiate a chemical reaction that causes the powder molecules to form complex cross-linked polymers that shall give the material its beneficial properties.

d) **CURE:** Following powder application, the coating shall be allowed to cure a short period (approximately 30 seconds) during which time it shall harden to a solid. The curing period shall be followed by an air or water quench to reduce the bar temperature to facilitate handling.

Fusion-bonded epoxy coating shall protect against corrosion by isolating the steel from oxygen and chloride. Epoxy coating shall have high electrical resistance, which shall block the flow of electrons that make up the electrochemical process of corrosion. In addition to serving as an electrical circuit breaker, the coating shall protect in another way that is less obvious. Coating a steel surface shall reduce the size and number of potential cathode sites, which limits the rate of any corrosion reaction. in order for macro cell corrosion to take place, a large area of steel surface shall be needed to act as a cathode where oxygen reduction can occur.

Thickness for FBE coating shall not be less than 200 to 250 microns.

iii. STACKING & HANDLING: The epoxy-coated bars shall be stacked & handled carefully in steel yard during laying. The coated bars shall be carefully handled in order not to drop them, not to rub them on hard surface or against another coated bar while conveying, stacking, placing or stacking of fabricated bars & that for this purpose, wooden packing batons shall be used at spacing of not more than 60 cm. The coated bars shall be tied to make bundles with PVC binding material to avoid damages to coating. The cut ends of bars shall be touched up with special touch up materials of specifications as provided by coating agency. There shall be minimum time gap to repair the cut ends and damaged portions with touch up materials and that failure to do so may cause complete rejection of the coated bars the cut ends and damaged portions shall be touched up with repair patch-up material within four hours time gap. All damages to coating in handling etc. shall be repaired irrespective of their size. This stipulation supersedes provision of I.S.Code.

iv. **MEASUREMENT:** The coating shall be done as per manufacture's specification & as directed by consultant. The measurement of reinforcement bars shall be taken in accordance with IS code & as specified in description.

34 CEMENT POLYMER COMPOSITE COATING

The application of the cement polymer composite coating system comprises the following sequence :

i. SURFACE PREPARATION: The surface of the steel reinforcing bars to be coated shall be cleaned by abrasive (dry sand) blast cleaning to the near-white metal in accordance with SSPC - SP10/NACE No. 2-1994. It includes the following procedures:

a) Prior to blast cleaning visible deposits of oil or grease shall be removed by suitable cleaning method.
b) Clean dry compressed air shall be used for nozzle blasting.
c) Dry uniformly graded silica sand shall be used for blast cleaning.
d) Suitable arrangement shall be made in the sandblasting unit to suit automation.
e) The pressure at the nozzle shall be regulated as per the supplier's specifications.
f) Dust and residues shall be removed from prepared surface by brushing, blowing off with dry air.
g) The surface shall meet the visual standards of comparisons as in SSPC- VIS1 or SSPC-VIS2.

ii. APPLICATION OF THE COATING:

a) The coating shall be applied as soon after cleaning and before oxidation of the surface. However, the application of the coating shall not be delayed more than 4 hrs after cleaning.
b) A rapid setting primer shall be applied over the prepared surface either by brushing or dipping.
c) After 30 minutes of application of the primer a cement polymer-sealing coat shall be applied either by brushing or dipping.
d) The coated rods shall be handled after 6 hrs.

iii. REQUIREMENT OF THE COATED BARS:

(a) Thickness of The Coating: After curing, the minimum average the dry film thickness of the coated bars shall not be less than 150 + or - 25 microns.

(b) Continuities of The Coating: The coated rod when visually examined should be fairly uniform in thickness and should be devoid of any defects as cracks, peeling, bulging etc. No surface area should be left uncoated. No rust spot should be visible with the unaided eye.

iv. SPECIFICATION FOR PATCH REPAIRING OF COATING DAMAGES:

a) Coating repair is required when peeling off and other damages exist. Prior to repairs, loose or deleterious material from the damaged area shall be cleaned. In case where rust is present it shall also be mechanically removed prior to repair.
b) After this, primer coat shall be brush applied. After curing (15-30 minutes) sealing coat shall be applied and it is desirable to ensure a thickness of 150 microns.

SPECIFICATIONS FOR CUTTING, BENDING AND WELDING OF COATED REBARS AT FIELD :

(i) It is desirable that the coated rods shall be bend gradually.

(ii) In the field, the cut and weld portion of the coated rebars shall be repaired by the same formulation.

(iii) It is advisable that the binding wires shall also be coated by the same formulation.

THE COATING SYSTEM OF A PRIMER AND A SEALING COAT :

(A) The primer shall have rapid Setting property as per Indian Pat. No. 481/DEL/93. Dated 13.05.93. The specification of primer shall be as under:

I)	Percentage of Solids	:	30%
II)	Coverage	:	160 cc/m2
III)	Colour	:	Strawberry

(B) The Sealing product shall be formulated with Resin mixed with a pigment. Indian Pat. No. 259/DEL/92. Dated 25.03.92. The specification of Sealing product shall be as under:

I)	Percentage of Solids	:	30%
II)	Coverage	:	300 cc/m2
III)	Colour	:	Olive Green

(C) A Passivating-cum-barrier type of coating and the product shall be formulated in such a way that due to elasticity and flexibility of the coating, the treated bars can be cut and bend afterwards.

35 Applicable Codes and Specifications:

The following specifications, standards and codes of practice (Latest edition) apart of these specifications and which are referred to herein shall be applicable all official amendments and revisions.

A	IS	383	Specification for coarse and fine aggregates from natural sources for concrete
B	IS	432	(All 2 Parts)– Specification for mild steel and medium tensile steel bars and hard drawn steel wire for concrete reinforcement. Part 1 - Mild steel and medium tensile steel bars, Part 2 - Hard drawn steel wires
C	IS	456	Plain and reinforced concrete - Code of Practice
D	IS	875	(All 5 Parts)– Code of Practice for design loads (other than earthquake) for buildings and structures
E	IS	1038	Specification for steel doors, windows and ventilators

F	IS	1077	Common burnt clay building bricks - Specification
G	IS	1200	(Relevant Parts) – Method of measurement of building and civil engineering works
H	IS	1239	(All 2 Parts)– Mild steel tubes, tubulars and other wrought steel fittings, Part 1 - Mild steel tubes, Part 2 - Mild steel tubulars and other wrought steel pipe fittings
I	IS	1343	Code of Practice for prestressed concrete.
J	IS	1443	Code of Practice for laying and finishing of cement concrete floor tiles.
K	IS	1542	– Specification for sand for plaster
L	IS	1566	– Specification for hard-drawn steel wire fabric for concrete reinforcement
M	IS	1742	– Code of Practice for building drainage
N	IS	1786	– Specification for high strength deformed steel bars and wires for concrete reinforcement
O	IS	1893	– Criteria for Earthquake resistant design of structures
P	IS	1904	– Code of Practice for design and construction of foundations in soils; general requirements
Q	IS	2212	– Code of Practice for brickwork
R	IS	2502	– Code of Practice for bending and fixing of bars for concrete reinforcement
S	IS	2751	– Code of Practice for welding of mild steel plain and deformed bars for reinforced concrete construction.
T	IS	2911	(All 4 Parts)– Code of Practice for design and construction of pile foundations
U	IS	2974	(All 5 Parts)– Code of Practice for design and construction of machine foundations
V	IS	3370	(All 4 Parts)– Code of Practice for concrete structures for storage of liquids
W	IS	3764	– Code of safety for excavation work.
X	IS	4014	– (All 2 Parts) Code of Practice for steel tubular scaffolding
Y	IS	4081	– Safety code for blasting and related drilling Operations
Z	IS	4138	– Safety code for working in compressed air
AZ	IS	6248	– Specification for metal rolling shutters and rolling grills
BZ	IS	9103	– Concrete Admixtures - Specification
CZ	IS	10262	– Recommended guidelines for concrete mix design
DZ	IS	14687	– False work for concrete structures - Guidelines

SPECIFICATIONS OF PLUMBING, DRAINAGE & WATER SUPPLY

. **Materials**:

- CPVC pipes shall be used for all internal Water Supply Pipe works.
- G.I. (B-Class) / CPVC pipes shall be used for all External Water Supply Pipe works.
- uPVC pipes shall be used for all Soil Waste, Rain Water and Drainage works.

uPVC Pipes for Soil, Waste and Rain Water, Planter and AC drains shall conform to I.S.13592-1992 (type - B, SWR quality) for concealed pipe within the toilet sunk portion. The jointing of the pipes shall be in solvent cement joints. All the shaft piping shall conform to I.S.13592- 1992 (type - B, SWR quality). Vent Piping shall conform to I.S.13592- 1992 (type - A, SWR quality). All jointing in the shaft shall be by rubber ring joints. Rubber rings shall conform to IS 5382 and fittings to BS 4515 DIN 19531 & 19534. All the fittings like tees, bends, couplers cross etc. shall conform to IS 7834-1975. The joints of uPVC Pipes recommended shall be solvent cement, flanged, or threaded, joints. Pipes and fittings shall be free of any defects like cracks, etc.

Testing:

Inspection & Testing Pipes and Fittings before Commencing Work:

All Pipes & Fittings shall be inspected before delivery at the site whether they bear where appropriate, the certification mark of the I.S.I.

Testing of Service Pipes and Fittings:

When the service is complete, it shall be slowly and carefully charged with water allowing all air to escape and avoiding all shock or water hammer. The Service shall be inspected under working conditions of pressure and flow. When all draw-off taps are closed, the service pipe shall be absolutely water-tight.

Painting:

a. All exposed G.I. pipes and fittings shall be painted with 2 coats of approved shade enamel paint over a coat of Zinc Chromatic primer while M.S pipes shall be painted with 2 coats of Zinc Chromatic primer with 2 coats of enamel pint to the satisfaction of Engineer / Employer.

b. All pipes concealed through wall of floor shall be protected with anticorrosive paint and hessian cloth.

Sanitary Fixtures:

All glazed Vitreous china sanitary ware shall conform to Indian Standard IS: 2556. The Vitreous China Sanitary ware shall be of first quality only. They shall be non-porous and fully vitreous, with all the visible portions perfectly glazed and should absolutely be free from hairline cracks, pin-holes and local depressions. They shall be perfectly symmetrical, uniform and smooth. The chromium plated fittings shall match the vitreous china fixtures.

Valves and Controls:

All Valves (gate, globe, check, safety) shall be either all brass or gun metal valves suitable for the particular services. All valves shall be of the particular duty and design called for. Valves shall either be of the screw type or flange type, with suitable flanges and non-corrosive bolts and gaskets. Tail pieces as required shall be supplied along with valves. Gate, globe and check valves shall conform to Indian Standard IS:778-1971 (Gunmetal gate, globe and check valves for general purposes) and non-return valves to swing check type reflex (non return valves IS:5312 (Part I) 1969.

Codes & Standards:

. All the applicable codes and standards updated and in force published by the Bureauof Indian Standards (BIS) and its subsequent revision and all other standards which may be published by them before construction work starts, shall govern in respect of design, workmanship, quality and properties of materials and method of testing for Plumbing, Drainage and Water Supply etc.

All materials shall conform and bear stamps of the required Indian Standard specifications.

The following is the list of applicable codes:

IS : 651 - 1980 Specification for salt glazed stoneware pipes and fittings.

IS : 778 - 1984 Specification for gunmetal gate, globe and check valves for water.

IS : 780E - 1984 Specification for sluice valve for various purpose.

IS : 781 - 1978 Specification for sand cast brass screw down bib taps and stop for water services.

IS : 782 - 1983 Specification for caulking lead

IS : 1172 - 1971 Basic requirement of water supply drainage and sanitation

IS : 1239 - 1982 Specification for M.S. or G.I. Pipes.

IS : 1536 - 1989 Specification for LA class Centrifugal cast (spun) iron pressure pipes for water and sewage.

IS : 1538 - 1976 Specification for cast iron fittings for pressure pipes for water and sewage.

IS : 1703 - 1977 Specification for ball valves (horizontal plunger type) including floats for water supply purpose.

IS :	1879 - 1975	G.I. Fittings
IS :	3989 1984	Specification for Centrifugal cast (spun) iron pipes for Sewage.
IS :	1729 1979	Specification for C.I. Sand cast pipes.
IS :	544 - 1975	Specification for threads of G.I. fittings (parallel female and taper male threads).
IS : BS -	5155	Specification for Valves for various purposes.
IS :	1726 - 1974	Specification for cast iron manhole covers and frames intended for use in drainage work.
IS :	1729 - 1979	Specification for cast iron spigot and socket, soil, waste pipes, fittings and accessories.
IS :	1742 - 1983	Code of practice for building drainage.
IS : 2064 - 1973		***Code of practice for selection, installation and maintenance of sanitary appliances.***
IS :	2065 - 1983	Code of practice for water supply in buildings.
IS :	2373 - 1981	Specification for water meters. (Bulk type).
IS :	458 - 1971	Specification for reinforced cement concrete hume pipe.
ASTM – D –	1785	Specification for High Pressure UPVC Pipes

B) Specifications of Works for Mechanical Components including Fire Fighting & Car Parking Systems

1. Applicable Standards:

Unless specifically mentioned otherwise all the applicable codes and standards updated and in force published by the Bureau of Indian Standards (BIS) and its subsequent revision and all other standards which may be published by them before construction work starts, shall govern in respect of design, workmanship, quality and properties of materials and method of testing. Some of these available standards are listed below:

(All materials shall conform and bear stamps of the required Indian Standard specifications).

I.S.1239	Specifications for G.I. Pipes
I.S. 778	Specifications for Gun Metal gate, globe, and check valves for water
I.S. 800	Specifications for Structural steel.
I.S. 3589	Specifications for ERW black pipes for water, gas and sewage Class I.

I.S. 814	Specifications for covered electrodes for metal arc welding purpose of structural steel
B.S 5155	Specifications for C.I. butterfly valve
I.S. 4927	Specifications for Canvas Hose pipes
B.S.1641	Specifications for C.I. Screwed fittings.
I.S. 903	Specifications for Branch pipes
I.S. 3844	Code of practice for installation of internal fire hydrant in Multi storied building.
.S. 5290	Specifications for landing valves (Courtyard Hydrant)
I.S. 903	Specifications for coupling double male double female Instantaneous pattern for fire fighting
I.S. 2217	Recommendation for providing first aid firefighting arrangement in public buildings.
I.S. 1879	Malleable Iron fittings Parts I to X.
I.S. 1200	Method of measuring of building & civil engineering works (Water Supply, Plumbing Drain and sanitary fittings)
I.S. 1538	Specifications for cast iron fittings for pressure pipes for water, gas and sewage.
I.S. 4853	Recommended practice for radiographic inspection of Fusion welded butt joints in steel pipes
I.S. 636	Synthetic, jacketed hose pipes
I.S. 1520	Electrically Operated multistage/ multi-outlet pump
I.S. 2198	Control Panels

Works to comply with Local Regulations:

All Fire Fighting works shall confirm to the prevailing local Bye-laws and/or rules and regulations of Local Bodies and the works shall be got inspected and approved by the various authorities having jurisdiction.

The work shall be carried out through a licensed Fire Fighting Agency.

In the interior of the building, all pipes whether of cast iron or G.I. shall be embedded in an approved manner in chase made in walls or floors if required by the Engineer-in-charge. The Contractor shall make all necessary holes in the walls of masonry and concrete etc. and restore them to the original condition.

All cuttings, chasing and fixing work concealing work, shall be completed before commencement of any plastering tiling or finishing work.

The contractor shall be responsible for the adequacy and efficiency of the entire system.

The materials & equipments to be incorporated for use in construction of the work shall the responsibility of the contractor in totality.

The equipment of the fire-fighting system / fire prevention system shall be tested independently at various intervals and at completion. Where the situation calls for sectional testing (e.g. before embedding any piping within the building structure or before covering up pipes laid in trenches), the contractor

shall promptly arrange such testing. All testing shall be done in the presence of Engineer-in-charge's representative and at intervals as desired by him. The contractor shall record all testing done by him in a 'Log Book' of approved form. The test results shall be countersigned by the representatives of both the Contractor and Engineer-in-charge. The contractor shall arrange for all facilities, labour, materials, kit and instruments required for testing. All expenses thereof shall be borne by the contractor.

2. Fire Hydrant & Sprinkler System

2.1 Materials:

All materials shall conform and bear stamps of the required standard specifications.
Samples of all materials shall be approved before placing order and the approved samples shall be deposited with Engineer-in-charge.
If so directed, materials shall be tested in an approved testing laboratory and the Contractor shall produce the test certificate in original to the Engineer-in-charge and the entire charges for original as well as repeated tests shall be borne by the Contractor. If required by the Engineer-in- charge, the Contractor shall arrange to test portion of the work at his own cost in order to prove their soundness and efficiency. If after any such test, the work or portions of work is found in the opinion of the Engineer-in-charge, to be defective or unsound, the contractor shall pull down and the same at his own cost. Defective Material shall be removed from site.
It shall be obligatory for the Contractor if so required by the Engineer-in-charge to furnish certificates from manufacturers or materials suppliers, that the work has been carried out using their materials and installed/fixed as per their recommendations/factory manuals.

2.2 Steel Pipes:

The M.S. pipes of 200 mm dia and above shall conform to IS:3589-1981 Class I Grade 330 with 6 mm wall thickness and 150 mm dia and less G.I shall conform to IS: 1239 (Mild Steel Pipes, Tubular and Wrought Steel) heavy class only.

2.3 Galvanising:

Galvanising shall conform to I.S. 2529 (Hot Dip galvanising of iron and steel). On delivery to site, the pipes and fittings shall be inspected for the galvanised coating and shall have identification for the class of pipes. Pipes with damaged coatings shall be segregated & removed from the site and not be used in the installation.

2.4 Welding of Pipes:

The welding of M.S or galvanised pipes and fittings shall be in accordance with "Recommendation for metal Arc welding of carbon and carbon manganese steel". IS: 9595 - 1980. The electrodes used for welding shall comply with I.S 814 (part -1) 1974 and IS: 814 (part-2) 1974.
Preparing pipe faces for welding: Before aligning, assembling and welding the pipe faces shall be cleared by scraping by wire brushes or any other method specified by the construction Manager.

The welding shall show evenness in ripples or waves and well formed beds with good fusion along the edge of weld. There shall be no unfilled cavities, small pockets of slags or burned metal air or gas pockets.

2.5 Testing of Welded Joints:

The welded joints shall be tested in accordance with the procedure laid down in I.S.3600,(Part I) 1973 suitable means as desired by Engineer-in-charge.

2.6 Welding of Closure Gaps:

Final welding of closure gaps shall be carried out with in a temperature range of average air temperature +8 Degree C.

2.7 Jointing of Pipes:

All pipes M.S./G.I. shall be joined by means of arc welding after laying in correct position and shall have flanged joints at every 20 M straight length and at change in direction/change in size/branch connections. M.S. Flanges shall conform to I.S 1538 part IV to part VI table E which shall be cut and drilled out of M.S. Plates. M.S. cut flanges shall be galvanised before welding to G.I. Pipes. All gaskets for flanged joints wherever required shall be of Neoprene 6mm thick with G.I. nuts and bolts. Welded joints shall be covered with a coat of epoxy paint, applied after preparation of surface and appropriate primer.

Inspection Before Installation:

M.S and G.I. pipes, fittings and specials shall be inspected before delivering at the site for the brand, quality, etc. The pipe and fittings shall be inspected at the site again before laying and defects noticed, if any, such as protrusion, grooves, dents, etc. shall be rectified. Care shall be taken that the resulting wall thickness does not become less than the minimum. Any damaged portion shall be cut-out as a cylinder and replaced by an undamaged piece of pipe.

2.8 Handling Of Pipes And Specials:

It is very essential to avoid damage to the pipes, fittings specials etc., at all stages during handling. The pipes & specials shall not be distorted of their circular shape and galvanising shall not be damaged. Pipes shall not be thrown down while unloading.

2.9 Laying of Pipes:

The pipes cut to required lengths shall be laid to required gradients and joined by welding or by flanged joints as called for. The laying of welded pipes shall comply to IS:5822-1986, "Code of practice for laying of welded pipes for water supply".

2.10 Testing of Pipe Line:

a. <u>Field Test :</u>
The field test of pipes shall be carried out as per I.S. 1538.

b. <u>Procedure of Test:</u>
All air shall be expelled from the pipe line through hydrants and air valves. Each valve section of pipes shall then be slowly and carefully filled with water and allowed to stand full of water for a few hours if time permits. The specified test pressure based on the elevation of lowest point of the line or section under test and corrected to the elevation of the test gauge shall be applied by means of a pump connected to the pipe in a manner

satisfactory to the Engineer-in-charge. Due precaution shall be taken to ensure that the required test pressure is not exceeded. Pressure gauges shall be accurate and shall preferably have been re-calibrated before the test. The test pump having been stopped, the test pressure shall maintain itself without measurable loss for at least Two hours or as directed by Engineer-in-charge. The pipes shall be tested in sections as the work of laying Proceeds, and joints inspected during testing. The open end of the pipe line may be temporarily closed for testing under moderate pressure by fitting a water tight expanding plug. The end of the pipe and the plug shall be secured by struts or other wise to resist the end thrust of the water pressure in the pipes.

2.11 M.S. C.I. Brackets/hangers:

All M.S. Brackets/Hangers for supports of M.S, G.I. pipes and fittings shall be fabricated out of mild steel section such as channels, Angles, Tees, Flats etc., or shall be cast iron as per site conditions as per drawing or as suitable, as per I.S. Code. The brackets, hangers etc. shall be fabricated to required sizes and shapes and installed in position as shown on drawings or as required as per site conditions. The welding and other Operations involved in fabrication shall be carried out as per relevant specifications and best trade practices.

M.S. Brackets/Hangers shall be thoroughly cleaned by wire brush to make the surface clear from any rust before application of paint. The brackets/Hangers shall be fixed to the ceiling by Anchor fasteners, as directed by the Engineer-in-charge. In case the brackets cannot be fixed by above method due to site condition, they shall be grouted in to the slab with the permission and as directed by the Engineer-in-charge.

Sturdy Hanger, Brackets and saddles of approved design shall be installed to support all pipe lengths, which are not embedded over their entire run. The hangers and brackets shall be of adjustable heights and primer coated with zinc chromate primer. Clamps, collars and saddles to hold pipes shall be provided with nuts, bolts and suitable gaskets. The brackets and hangers shall be designed to carry the weight of pipes safely and without any deflections. All pipes and fittings shall be supported at a maximum of 3 M run of pipe and at change of direction or wherever required as per site conditions. Where called for, pipe hangers shall also be supplied with proper sound and vibration dampening devices, to minimize noise and vibration transmission.

Details of piping support both for Horizontal and vertical pipes are shown in the relevant drawings and shall be strictly followed by the Contractor.

Fire water main pipes or headers shall be supported on M.S. Cradles, fabricated out of M.S. angles of suitable size and verticals made out of M.S. flat of suitable size hooked to reinforcement in slab above and pocket grouted properly.

2.12 Painting:

This painting clause is applicable to all the structural & mechanical items, cabinet housing electrical controls etc. Items manufactured indigenously will follow relevant standards by Bureau of Indian Standards. For items manufactured outside India EN standards may be followed.

Painting shall be applied to all iron and carbon steel surfaces exposed to the atmospheric action after surface preparation. Items made of asbestos, aluminium, brass, bronze, galvanized steel, stainless steel and other corrosion resistant alloys, rubber, synthetic polymers, fibre reinforced plastics, and buried pipe work (for which separate protection is required) are not required to be painted except for aesthetic purposes and / or for identification.

The painting process will consist of surface preparation, Application of prime coat, application of intermediate coat where required and finally application of the finish coat and touch up.

The paint material shall conform to the relevant standards by Bureau of Indian Standards. The Make & Shade of the paint shall be approved by the Engineer / Employer.

Primer paint shall be applied on dry and clean surfaces. Intermediate paints formulated with micaceous iron oxide (MIO) to be applied over prime coats where required as an intermediate layer to provide weather proof sealing of prime coat. Finish paint of approved colour to IS 5 shall applied over prime and intermediate coats. Proper cleaning and touch up should be done at all level.

The colour scheme for the moving items shall follow the relevant standards by Bureau of Indian Standards.

2.13 Standards for Painting

1	IS	5	Colours for ready mixed paints and enamels
2	IS	384	Brushes, Paints and Varnishes, Flat Specification
3	IS	958	Temporary corrosion preventive grease.
4	IS	1153	Temporary corrosion preventive fluid
5	IS	2074	Ready Mixed Paint, Air Drying, Red Oxide Zinc Chrome, Priming - Specification.
6	IS	9954	Pictorial Surface Preparation Standards for painting of Steel Surfaces
7	IS	10949	Code of Practice for Painting procedure for Machine Tools.
8	ISO	8501-1	Preparation of steel substrate before application of paint.
9	SIS	05590-0	Pictorial surface preparation standard for painting of steel.

2.14 C.I. Non Return Valves:

The non-return valve shall be double flanged cast iron of approved make. Re coil check valve with cast iron body with all internals made of Gun Metal or Wafer Type Check Valve.

2.15 Orifice Plates:

These shall be specially designed orifice plates wherever required on hydrant outlets of suitable size for adjustment of delivery pressure, where running pressure exceeds 7 kg/cm2.

2.16 Hydrant Valves:

Hydrant valves shall be as per I.S. 5290. The hydrant valves shall be Gun Metal Morris pattern approved by Fire Brigade with necessary nuts, bolts,& gaskets etc. The valve shall be right angled, turn down and other types having instantaneous female plunger type out lets with chained blank cap. Flanged inlets gunmetal or light alloy with C.I. Or brass hand wheels tested to 21 kg/cm2 pressure. The valves shall be either single outlet or Double outlet as required.

2.17 Fire Brigade Connection:

Fire Brigade inlet connection with 4 (four) connecting points fabricated out of G.I. Pipes and incorporating a C.I. non return valve for fire and sprinkler system. The fire brigade connection shall be connected to the 1) Fire storage tank 2) Fire wet riser system 3) Sprinkler system at appropriate locations.

2.18 Sprinklers:

Sprinklers shall be `GRINNEL/AUTOMATIC' Type F UNDER WRITERS LABORATORY/Factory mutual listed or approved equivalent. The bulb shall be quartzoid bulb with a temperature rating of 68 deg.C. The sprinklers shall be pendant type / Side Wall / Recessed type as called for.

The Orifice size shall be 15 mm with Gun Metal Body, Bronze finish and quartzoid bulb as heat sensitive element and universal deflector. The discharge pattern for pendant sprinklers shall be spheroidal covering an area of 9 sq. meters. Sprinklers shall be mounted up right/ suspended in pendant position.

2.19 Installation Control Valve:

Installation Control valves shall be wet type, flanged of suitable size with cast iron body, Bronze seating Alarm valve clack, Drain and test valve, pressure gauge on upstream and downstream and water motor going to be automatically Operated on loss of pressure in the system. The water motor gong shall be pelton wheel type or electric alarm.

2.20 Court Yard Hydrant:

The Court Yard Hydrant landing valve shall be as per I.S. 5290. The valve shall be a single outlet oblique type hydrant valve with instantaneous coupling Gun Metal Body and hand wheel to be fixed on a stand pipe of minimum 80mm dia.

2.21 Hose Pipe For Court Yard Hydrant:

Fire hose shall be synthetic, jacketed type with unified lining and cover of special polymer compound designed to resist impact, abrasion, damage, weathering by ozone, burning oils

and chemicals. It shall conform to IS : 636 type B with instantaneous couplings (Male & Female) screwed, with 16 gauge G.I. wire on either ends.

2.22 Connection Pipes:

Connection pipe shall be as per IS-903 long type with copper body with Male inlet and screwed bronze type 20 mm nozzles.

2.23 Pressure Gauge:

The pressure gauges shall be of 'BOURDEN TYPE' with +/- 1% accuracy. The size or diameter of the dial shall be 150mm with a pressure range from 0 to 16 kg./sq.cm. The measuring element type shall be `BOURDEN' and material shall be SS-316.

2.24 Automatic Sprinkler and Fire Alarm Installation (Wet System):

Installation Control Valves and shall be wet type, flanged of required size with C.I. body, bronze seating alarm valve clack, drain and test valve, pressure gauge on upstream and downstream and water motor going to be automatically Operated on loss of pressure in piping. The water motor gong shall be pelton wheel type or electric alarm.**Stop Valve:**

The valve shall be of wedge type and be provided with an indicator showing the valve in open or closed position. It shall be secured in the open position by a padlock and strap. This valve controls the water supply to installation and must always remain open.

2.26 Alarm equipment:

The Alarm equipment to be provided shall give a loud alarm in case of fire. This equipment shall come into Operation when water flows through the installation valves to sprinkler when opened due to fire. The equipment shall consist of simple and positive action main parts namely i) Alarm valve, ii) Alarm Stop Valve, iii) Alarm Motor & Gong

- **Alarm Valve:**

Alarm valve shall have a cast iron body & be fitted with a Bronze seating and valve guide clack resting on the bronze seating. The flat circular Bronze plate of the clack shall be faced with a special composition disc, and shall rest on the seating and prevent access of water to the groove. When water flows into the installation, clack shall lift and water shall flow through groove and open alarm stop valve to the alarm motor.

- **Alarm Stop Valve:**

Alarm stop valve shall have an indicator to show whether it is open or closed. Alarm stop valve shall control the flow of water from Alarm valve through annular groove to the alarm motor. It should have a strap to keep the valve in open position to give alarm when the fire takes place.

- **Alarm Motor and Gong:**

The Alarm Motor shall be of pelton wheel type. The whole unit shall be simple and robust construction and shall give a reliable service. Suitable Drain pipe shall be provided to discharge water through drip plug with an orifice to restrict the rate of discharge. This shall not impair the Operation of Alarm motor and gong.

2.27 Drain and Test Valve:

The drain pipe size shall be 50mm dia. The test valve shall have to be in closed position secured by a strap. 15mm dia size test valve shall be provided to test the Alarm when the test valve is

opened, water shall flow through Alarm valve, lift alarm valve clack from its seat and allow water to flow to the Alarm Motor. Valve shall be in closed position when not in Operation and shall be secured with the strap.

2.28 Examination Under Pressure

Under the test pressure no leak or sweating shall be visible at all section of pipes, fittings, valves, Hydrants & welded joints. Any defective workmanship and defective pipes, fittings, valves or Hydrants discovered in consequence of this pressure test shall be removed and replaced with acceptable material & the test shall be repeated until found satisfactory by the Engineer.

3. Testing:

The contractor shall be required at his own expense to test the installation with water. The minimum test pressure shall be 50% higher than the system pressure. Pressure shall be 50% higher than the system pressure. When the installation is completely carried out, proper stoppers, screws, plugs, hose, etc. must be provided for this purpose. If required, these shall be taken out and re-laid at the contractor's expense. The required quantity of water for testing will be provided by the owner. The installation shall be guaranteed against faulty material, workmanship and design. The defect liability period is for 12 months and design and the period commences from the date of commissioning of the whole installation along with the approved certificate from the authorities. During this period the contractor shall be responsible for any repairs or replacement of any defective part and shall rectify the installation free of cost to the owner.

The contractor shall train the GVSCCL/GVMC personnel for the proper maintenance of the installation.

4. Make of Equipments and Approved Manufacturers

1.	M.S. Pipe	a. TATA b. Jindal
2.	G.I. Pipes	a. TATA b. Jindal
3.	Sprinkler Heads	a. SHJD b. Sharp (Monsher)
4.	a) Ball Valve	a. RB b. VB
	b) G.M. Gate Valves	a. Leader b. Zoloto
5.	a) Electric Motor	a Siemens b. Kirloskar
	b) Pumps	a. Mather and Platt India Ltd. b. Kirloskar
6.	Installation Control Valves and Alarm Valves	a. Sanje b. Grinnel UL/FM listed

7.	Landing valve	a.	Monsher
		b.	Shah Bhogilal
8.	Fire Hose	a.	Flex Drops (Yong Won ENC LTD.
		b.	Jayashree (Permaline)
9.	Butterfly valves	a.	C&R
		b.	Intervalve
10.	GM Instaneous Coupling	a.	Monsher
		b.	Newage
11.	Air Release Valve	a.	Newage
		b.	Shah Bhogilal
12.	Gun Metal Branch Pipe with Instaneous type nozzle	a.	Monsher
		b.	Newage
13.	Pressure Gauge	a.	FIEBIG
		b.	Guru
14.	Alarm Flow Switch	a.	Senje
		b.	Procicorn
15.	Anchor fasteners	a.	Fischer
		b.	Hilti Fasteners.
16.	Paints	a.	Asian paints
		b.	Shalimar
17.	G.I. Pipe fittings	a.	Zoloto –M
		b.	R Brand
18.	Portable Fire Extinguishers	a.	Senje
		b.	Minimax
19.	C.I. Recoil type Non Return Valves	a.	Leader
		b.	Zoloto
20.	CI Sluice Valves	a.	Leader
		b.	Zoloto

SPECIFICATION FOR INTELLIGENT ANALOG ADDRESSABLE TYPE FIRE DETECTION AND ALARM SYSTEMS

1. The main / local fire alarm control panel and loop devices including sensors , Manual call points, interface & relay units should be sourced from the same ISO 9002 certified manufacturer to ensure compatibility between hardware and software.

2. All basic equipments proposed and planned for use shall be formally approved by at least one internationally recognised testing labs and/or approval from all the concerned authority for the system offered, few or which are listed below :

a) UL - Underwriters Laboratories, USA.
b) FM - Factory Mutual, USA.
c) B.S. - British Standards, Great Britain
d) U.L.C. - Underwriters Laboratories, Canada

3. Vendor shall obtain clearance and approval of drawings from the following Authorities

a) Local Fire Authorities
b) Tariff Advisory Committee

4. All control equipment's and loop devices including sensors, interface modules, relay units etc. are to be manufactured by a single company to ensure total compatibility and faultless communication of the FAS.

5. The system shall be capable of connecting signal devices (hooters, horns, flash light etc) & Monitor Devices (sensors, MCP's etc) in the same loop irrespective of difference in the principle of Operation and should not require separate loop. This would reduce the no. of cards installed in the system and thus maintenance would be easy.

6. Sensors should be provided in the ducting used for the air-conditioners in addition to those used below the ceiling.

7. The system shall be one of the latest generaltions of INTELLIGENT ANALOG SYSTMS whereby it shall be the FIRE ALARM PANEL that determines that a fire situation really exists and not the device in alarm. This should be possible so as to eliminate the false alarms.

8. The system should have the optional facility to be connected into a Network in future, by adding the required cards, and thus Operate as a Node of that Network while maintaining its Local Mode Operation.

9. Monitoring and Control Equipment:

9.1 Standard Features

i. The Fire Alarm Control Panel should be manufactured by a ISO 9002 company and be UL listed for NFPA 71, 72, UL 1076 Security Operation or similar and approved by FM or a similar laboratory in addition to approvals from local authorities.

ii. This should be capable of optional 100% Hot redundant Operation with identical other panel or 100% Redundant Operation with standby processor.

iii. To provide maximum efficiency in performing primary fire alarm functions, the main operator panel should give access only to the indication and interaction keys required in Emergency situation. For increased functionality opeartor should need to open "Access Door" to access the additional operator keys.

iv. The depth of the Operators interaction with the control panel should be protected by at least 4 software programmable Access levels so that specific functions may be allowed only to designated persons. It should be capable of assigning min 20 discrete passwords to identify individual operator. The user specific code shall be stored in the on line history log to identify the individual responsible for activating the function.

v. The main panel shall have a 2 X 40 character Back-lit Super Twist Alpha Numeric LCD Display screen, which may be visible under any lighting condition. Vacuum fluorescent displays, which may consume high levels of current and are not readily visible in high ambient light conditions, shall not be used. At least 40 character of the LCD display shall be available for customer text to describe the location of a zone or device.

vi. Each loop must be able to support minimum 127 addressable input and/or output devices in any combination.

vii. The memory of the panel shall be non-volatile. Systems requiring a power source to maintain site programmed data are not recommended.

viii. The system shall have self contained (internal) standby battery as a part f the Intelligent power supply with automatic charger. The charger must be capable of Automatically adjusting the Boost or trickle charger according to the requirement of the Battery. The charger must be able to charge the battery back up required for 24 hrs. of normal Operation and 10 minutes of alarm Operations in case of mains failure. There should be complete supervision of the power supply from main panel.

ix. The LCD Display on the main panel shall be capable of displaying all the information about the current status of the power supply, Battery and charger (low/no battery, Battery voltage, peak current, Battery current etc.)

x. The main panel should be able to supervise and monitor supervisor services (water flow switches, tamper switches etc.) in addition to the fire alarm system. There should be a dedicated supervisory service indicator LED & acknowledge on the main panel.

xi. Alarm, Trouble & Supervisory conditions should have separate LED's & acknowledge keys. Operation of the appropriate Acknowledge Button, silences the Tone Alert but the LED remains illuminated until all conditions in that category are restored to normal.

9.2 Software Features

i. The control panel shall be fully site programmable by Laptop computer i.e. field programmable, configurable and expandable in the field without the need for any material to enable such programming to be undertaken. A down loading facility with suitable hardware and software via a PC shall be provided.

ii. In addition to the above it should have the facility to connect an optional external CRT – keyboard and/or printer through RS – 232 port card. There should be no need to provide any extra software or compatibility of the printer / CRT keyboard with the main panel.

iii. The CRT should be able to display all the Historical logs and other information that the Main Panel displays. In addition it should be possible for the CRT/Keyboard to perform all the basic functions that the main panel performs.

iv. The system should have a One Person walk test capability to allow for one person to physically test system devices to reduce further maintenance costs. It should be possible to make a minimum of 8 walk test groups so that even if one group is in walk test the others remain in Normal Working condition.

v. The control panel must be fully field configurable, programmable and editable and should perform programmable functions like changing circuit labels, selective signaling, coding, selective relay control, priorities, cross zoning, 2-stage alarm etc.

vi. The control panel shall allow for cross zoning or looping of sensors i.e. an detector on any loop may be assigned to any zone. This will prevent the need for excessive wiring.

vii. The control panel shall have the facility of field selectable alarm verification by zone, by group of zones, or by system.

viii. The control panel should contain a non-volatile Historical Event Log with a minimum of 600 events ready for display or printing. Only printing is not acceptable substitute for Display. Trouble events (300) and alarm events (300) should be stored in a separate Log for easy diagnostics.

ix. The control panel shall have total control over the sensor in all respects. It should allow for sensitivity / alarm level programming for sensor so that the system is tailored to relevant site conditions.

x. The main control panel should be capable of displaying the detailed information about the sensor (current analog value, average analog value, set sensitivity, alarm level, address of sensor, condition of sensor, location of sensor, troubles if any etc.) on the LCD display.

xi. In case of the heat sensor the ambient temperature of the environment in which the sensor is mounted should be displayed on the LCD panel directly in °C or °F.

xii. A facility shall be provided to give a pre-warning of devices that were almost dirty. If actions not taken at this warning a second should be displayed telling that the sensor is "excessively dirty" and needs immediate maintenance.

xiii. It shall be possible to program a day/night facility with programmable alarm delay to reduce the unnecessary evacuation of the building during working hours.

xiv. Main panel shall have features like :

a) Field selectable signal silence inhibit
b) Software based field programmable (per circuit) selective zoned PNIS coded, temporal coded, march time coded or master coded Operation
c) Sprinkler flow/gate valve supervisory monitoring
d) Alarm / trouble resound
e) Supervised serial annunciator connection
f) Built-in alarm verification tally for alarm verification zones
g) Optional remote serial (two-wire) alarm and trouble annunciation with optional acknowledge and reset switch, trouble signal, trouble light and trouble signal silence switch

xv. There should be a optional facility in the main panel to integrate voice communications (one way communication). For details refer to Annexure -

xvi. The control panel should allow for addition of card for interfacing optional supervised serial annunciators, graphic annunciation modules etc.

9.3 Sensors:

a) **Intelligent Analog Addressable Photoelectric Smoke Sensor** compatible with a common base and approved by UL, ULC, FM or a similar laboratory. The sensitivity of this sensor should be adjustable from the Main Panel in 7 steps ranging from a minimum of 0.2% (UL Certified) to a maximum of 3.7% per foot of smoke obscuration.

b) **Intelligent Analog Addressable Heat Sensor** compatible with a common base and with combined Fixed Temperature Element and Rate of rise Element and approved by UL, ULC, FM or a similar laboratory. The Rate of rise Operation should be selectable in either a 15°F (8.3°C) per Minute or a 20°F (11.1°C) per Minute Rate of Temperature rise. Fixed Temperature setting should be entirely independent of the Rate of rise Operation and should Operate at 135°F (57.2°C)

c) Other Requirement of Sensors:

i. All intelligent Addressable Analog Sensors should be manufactured by the same manufacturer as that of the control panel so as to assure complete compatibility and communication with the system.

ii. All sensors (both f& heat) shall be similar in appearance so that, when different detectors are required within the same area, a balanced and asthetically pleasing effect is provided.

iii. A full range of detectors shall be available and identical in appearance as follows :

iv. Each detector's "hard" Address must be Dip Switch selectable and the switch must be within the detector's base only. The Dip-switch shall be below the sensor Head (In Base) to prevent the ingress of dust and other foreign matter.

v. Each detector shall incorporate a LED to for staff identifying the device in alarm. In the alarm condition, the LED shall illuminate continuously until the system is reset. In the normal working condition the device LED's will flash to a pre-defined time period indicating normal Operation of the unit. If any unit is incorrectly addressed, then the duplicate addressing shall be identified by the panel.

vi. All sensors shall be low profile & have an earth bonding point on each sensor base.

vii. All sensors shall have 30 mesh insect screens & have completely closed backs to restrict entry of insects, dust & air turbulence which may drastically affect the Operation of the detector.

viii. Electronics of the unit shall be completely shielded to protect against False Alarms from EMI & RFI.

ix. The sensors shall contain Locking screw to discourage unauthorised Tampering.

x. The detector should contain a functional test switch (magnetically Operated) that when Operated, will test the electronics of the unit and put it into the alarm.

xi. The sensors should have arrangement to connect to optional bases with sounder, Relay driver for Remote Relay & Remote Alarm LED indicator Operation.

xii. All sensors must have Automatic self test feature meeting NFPA 72 sensitivity Test requirements which tests the sensor every minute thus reducing maintenance cost.

xiii. All smoke sensors shall have the facility for selection of two sensitivities for a dual stage Operation. A system unable to satisfy this requirement is unacceptable.

xiv. All sensors should have a facility of Automatic Environmental compensation i.e. once set the sensitivity should remain fixed irrespective of the various environmental factors like Temperature, Humidity, Dust, Dirt etc. No Drift in the sensitivity shall be allowed.

xv. Wrong device connection must immediately give trouble condition at the panel. However the device must still Operate at its default setting to protect the premises.

9.4 LCD Repeater Panel:

i. An LCD Repeater Panel identical to the Main Control Panel Display and connected by suitable twisted pair shall be compatible with the Main Panel.

ii. The Repeater Panel shall its power from the main Panel and should not need a separate power supply.

iii. The Panel should have a 2 x 40 Character Back-lit, wide viewing Angle, Super-Twist Alpha Numeric LCD Display.

iv. It should have a switch for Lamp/LCD Test.

v. A maximum of 31 LCD Repeater Panels (Only Repeater Panels) should be able to be connected on the same communication line.

vi. Operation of Alarm Silence, Manual Evacuation, and system Reset keys shall initiate the appropriate action on the control Panel.

vii. The Repeater & Main Panel shall monitor each other for fault conditions and any anomalies in either Panel shall cause the relevant fault LED to illuminate and buzzer to sound in both Panels.

INTEGRATED PUBLIC ADDRESS SYSTEM WITH FIRE ALARM SYSTEM

1. GENERALL DESCRIPTION:

1.1 The heart of the audio system is audio control board, which provides routing, and pre-amplification of digitized alarm tones and voice messages. Actual tones and human voice.

1.2 Message should be recorded in a digital format and store in the audio control board's message memory. When called upon, an integral voice tone generator (VTG) should recreate the audio waveforms of the prerecorded voice/tone message to sound completely neutral. The audio control board should receive instruction from the master controller to direct the routing of the audio tones, codes and pre-recorded or manual voice message to the appropriate audio output circuits. Zone coded signaling should also be available using tones or spoken numbers.

2. Make of Equipments and Approved Manufacturers

1.	Fire Alarm Panel (Addressable type)	a. Edwards b. Simplex c. Notifire d. Morley
2.	Detectors	a. Edwards b. Simplex c. Apollo d. System Sensor
3.	Cables	a. Polycab b. LAPP c. Finolex

SPECIFICATIONS FOR CAR PARKING SYSTEMS

1. Design & Specifications

The bidder has to provide the complete design, drawings and specification of each component to be used in Car Parking System with reference to following or any other relevant code / specifications:

(i) Euro norm Standards EN:14010:2003 for parking structure safety
(ii) American National Standard Institute (ANSI)
(iii) Building Officials and Code Administrators of America (BOCA)
(iv) International Standards Organization (ISO)
(v) Fire Protection for these semi automatic car parking systems should fulfill - National Fire Protection Association of America (NFPAA) as well as NBC (National Building Code) of India.
(vi) National Electric Code of America (NEC)
(vii) Safety Code for Mechanized Parking Garage Equipment of America (ASA.A113.1)
(viii) American Society of testing Materials (ASTM)
(ix) International Society for Measurement and Control (ISA)
(x) ISO 9000 – as per latest data available
(xi) American Society of Mechanical Engineers code on Storage Retrieval (S/R) Machines and Associated Equipment (ASME B30.13)
(xii) National Mechanical Code of America (NMC)

In line to the above standards the contractor must take care of the following aspects:

a) The contractor must use structural steel of following grades for semi automatic parking systems :

- Rolled steel sections: IS 2062 Fe 410W A
- Plates up to 20 mm thickness: IS 2062 Fe 410W A
- Plates above 20 mm thickness: IS 2062 Fe 410W B
- Sections & plates -medium or high tensile steel: IS 8500
- Circular steel tubes: IS 1161 Yst 240
- Rectangular or sq hollow steel sections: IS 4923 Yst 240
- Rails or crane rails: IS 3443

b) This steel must be galvanized.
c) No compromise must be made in safety. All the components of the car parking systems must match international safety standards as per the codes mentioned above.
d) Adequate sensors must be provided by the contractor for these semi automatic car parking systems as per the above standards so that the functioning is very smooth.

2. Technology

The bidder will also provide the following details / documents:

i. Certificates from concerned authority of the projects where the proposed parking technology/product has been installed in either India or abroad stating its functionality.
ii. Certificate from the vendor regarding suitability in context of the site.
iii. Technology management & know-how transfer arrangements.

3. Concept

a) Based on surveys and investigations conducted by the Contractor, the Contractor will Plan a comprehensive proposal for providing the Car Parking Facility for a total of 396 car spaces through 7 level structure (6 levels above ground floor and one level below ground) – 264 car spaces in the Super Bazaar area as well 132 car spaces in the Police Chowki area and to allocate covered space for 164 Two-Wheelers on the ground floor of the Facility in Super Bazaar area.

b) 4 levels shall be proposed to be allocated for Sedans and 3levels shall be allocated for SUVs / cars with carriers. A Sedan slot must allow a car of at least 1700mm height, and a SUV / cars with carriers slot should allow a car of 2250 mm height.

c) Provision for disabled persons' car parking spaces has to be provided at ground floor.

d) The sophisticated mechanism at the entry exit gate of the bomb detection unit must be equipped with scanning system so that the car to be parked is scanned in terms of length, width, weight and height. This must be done so that a car of dimensions which is not suitable to be parked in the car parking tower is denied entry in the premises and is asked to be removed from the bomb detection unit through a display board.

e) The parking capacity must be worked out in terms of no. of Equivalent Car Space (ECS) proposed.

f) While designing, the Contractor shall take care of Integration Arrangement with surrounding traffic flow and street network

4. Evacuation Time

Evacuation time for all the 90 cars must not be more than 2.5 hours.

5. General Specifications for the Car Parking Facility

i. Once the car enters the premises, it is to be cleared through a bomb detection test.

ii. Before parking the Car, the user has to authorize himself / herself though a swipe card / bar coded ticket / permanent access card as prescribed in the car parking management system.

iii. The average time taken for the semi automatic car parking system to park and retrieve cars must not exceed 3 minutes 30 seconds, on an average.

iv. The minimum length, width and weight allowed for each car in the semi automatic car parking system must be 5.2 meters, 2.1 meters and 2.25 tons respectively.

v. The noise level of the car parking systems must not exceed 90 db during any given time.

vi. Both the DG Sets should be connected to the car parking systems to park and retrieve cars in case of power failure.

6. Standards

The following Standards are applicable to structural work. However this list is not exhaustive:

1	IS	5	Colours for ready mixed paints and enamels
2	IS	277	Galvanized steel sheets (plain and corrugated)
3	IS	800	Code of Practice for general construction in steel
4	IS	814	Covered electrodes for manual metal arc welding of carbon and carbon manganese steel
5	IS	816	Code of Practice for use of metal arc welding for general construction in mild steel
6	IS	822	Code of Procedure for inspection of welds
7	IS	875	(All 5 Parts)– Code of Practice for design loads (other than earthquake) for buildings and structures
8	IS	1024	Code of Practice for use of welding in bridges and structures subject to dynamic loading
9	IS	1030	Carbon steel castings for generall engineering purposes
10	IS	1161	Steel tubes for structural purposes - Specification
11	IS	1182	Recommended Practice for radiographic examination of butt joints in steel plates.
12	IS	1254	Corrugated aluminium sheet
13	IS	1363	(All 3 Parts)– Hexagon head bolts, screws and nuts of product grade C
14	IS	1364	(All 5 Parts)– Hexagon head bolts, screws and nuts of product grade A and B
15	IS	1367	(All 20 Parts)– Technical supply conditions for threaded steel fasteners
16	IS	1477	(All 2 Parts)– Code of Practice for painting of ferrous metals in buildings
17	IS	1852	Rolling and cutting tolerances for hot rolled steel products.
18	IS	1893	Criteria for Earthquake resistant design of structures
19	IS	2016	Specification for plain washers

20	IS	2062	Steel for general structural purposes - Specification
21	IS	2074	Ready mixed paint, air drying, red oxide-zinc chrome, priming - Specification
22	IS	2595	Code of Practice for radiographic testing
23	IS	2629	Recommended Practice for hot-dip galvanizing of iron and steel
24	IS	3443	Crane rail sections
25	IS	3600	(All 9 Parts)– Method of testing fusion welded joints and weld metal in steel
26	IS	3657	Radiographic image quality indicators
27	IS	3658	Code of Practice for liquid penetrant flaw detection
28	IS	3664	Code of Practice for ultrasonic pulse echo testings of contact and immersion methods
29	IS	3757	Specification for high strength structural bolts
30	IS	4000	Code of Practice for high strength bolts in steel structures
31	IS	4260	Recommended Practice for ultrasonic testing of butt welds in ferritic steel
32	IS	4759	Hot Dip Zinc coating on structural steel and other allied products
33	IS	4923	Hollow steel sections for structural use
34	IS	4943	Assessment of butt and fillet fusion welds in steel sheet, plate and pipe
35	IS	5334	Code of Practice for magnetic particle flaw detection of welds
36	IS	5372	Taper washers for channels (ISMC)
37	IS	5374	Taper washers for I-beams (ISMB)
38	IS	5374	Foundation bolts - Specification
39	IS	6623	Specification for high strength structural nuts
40	IS	6649	Specification for hardened and tempered washers for high strength structural bolts and nuts
41	IS	6755	Double coil helical spring washers
42	IS	7215	Tolerances for fabrication of steel structures
43	IS	7280	Bare wire electrodes for submerged arc welding of structural steel
44	IS	7293	Safety code for working with construction machinery.
45	IS	8500	Structural steel – Micro alloyed (medium and high strength qualities) - Specification
46	IS	8629	(All 3 Parts) Code of Practice for protection of iron and steel structures form atmospheric corrosion

47	IS	9595	Metal arc welding of carbon and carbon manganese steels - Recommendation
48	IS	12843	Tolerances for erection of steel structures

7. Car Parking Mechanical Machinery

7.1 General

7.1.1. Each machine is a complete unit serving a specific purpose. The selection, design and construction of the machine or any of its elements shall be to suit the specific purpose and satisfy the demands of good engineering practice. These guidelines are provided to maximize the interchangeability and to minimize the maintenance.

7.1.2. In the interest of availability of maintenance spares certain brands may be preferred over others. Regarding choice of machine or machine elements for foreign brands, the brand with presence in India will be preferred, provided the same is technically suitable for the purpose.

7.1.3. Components shall be designed to meet the specified requirements – hardness, strength, rigidity, resistance to wear and fatigue etc. Due care in their detailing is to be taken to avoid stress concentration.

7.1.4. Sub-assemblies and machine elements shall be easily dismantled without disturbing the neighboring units as far as possible.

7.1.5. All large and or critical rotating parts shall be statically and dynamically balanced.

7.1.6. After selection of the motor, the elements down the line should be designed for the maximum starting torque or break down torque whichever is higher

7.2 Manufacturing Methods

7.2.1. Carbon steel forgings will be as per IS 2004. Other forgings will be as per relevant IS.

7.2.2. Carbon steel black bars for production of mechanical parts will be as per IS 2073. Bright steel bars as per IS 9550 may also be used as raw material for production of mechanical parts, it the strength and other requirements permit.

7.2.3. Iron Castings will be as per IS 210 and IS 14329.

Steel castings will be as per IS 1030, IS 2644, IS 2707, IS 2708, IS 3444
Non-ferrous castings will follow the relevant IS.

7.2.4. Selection of electrodes, procedure, testing and any other aspect of welding in steel will be as IS 814, IS 822, IS 1182, IS 3600, IS 4260, IS 5334 and IS 9595. Welding and brazing of other metals will follow national and international practice.

7.2.5. Machining and tolerance of various items like couplings, gears, key and keyways, shafts, splines, sprockets, V-belt pulleys etc will be to relevant IS.

7.3 Mechanical Systems

7.3.1. Couplings, electric brakes, electric motors, fasteners, gear boxes, roller chains, V-belts, various kinds of ball and roller bearings etc will be bought out items of reputed and

approved brands. Appropriate factor of safety shall be used for all these items depending on torque transmitted / resisted.

7.3.2. For ball and roller bearings the expected ISO basic Operating hours L10h will be around 40 000 (forty thousand). The static rating of the bearings must have a appropriate, depending on the type of application, factor of safety over the rated loads.

7.3.3. For structural welded machine frames steps are to be taken to avoid time dependant distortion due to locked up stress. The seating of motor, gearbox etc is to be machined after fabrication. During assembly shim packs are to be used as required following good engineering practice.

7.3.4. Centralized lubrication is preferred.

8. Standard

The following Standards are applicable to Car Parking Mechanical Machinery. However this list is not exhaustive:

1	IS	28	Phosphor bronze ingots and castings
2	IS	210	Grey iron castings - Specification
3	IS	305	Specification for aluminum bronze ingots and castings
4	IS	306	Tin bronze ingots and castings
5	IS	318	Specification for leaded tin bronze ingots and castings
6	IS	617	Aluminum and aluminium alloy ingots and castings for general engineering purposes
7	IS	814	Covered electrodes for manual metal arc welding of carbon and carbon manganese steel
8	IS	816	Code of Practice for use of metal arc welding for general construction in mild steel
9	IS	822	Code of Procedure for inspection of welds
10	IS	919	(All 2 Parts) ISO system of limits and fits Part 1 Bases of tolerance, deviations and fits, Part 2 Tables of standard tolerance grades and limit of deviations for holes and shafts
11	IS	1030	Carbon steel castings for general engineering purposes
12	IS	1182	Recommended Practice for radiographic examination of butt joints in steel plates.
13	IS	1363	(All 3 Parts)– Hexagon head bolts, screws and nuts of product grade C
14	IS	1364	(All 6 Parts)– Hexagon head bolts, screws and nuts of product grade A and B
15	IS	1365	Specification for slotted countersunk head screws
16	IS	1366	Slotted cheese head screws - Product grade A

17	IS	1367	(All 20 Parts)– Technical supply conditions for threaded steel fasteners
18	IS	1368	Dimension of end parts with external ISO metric threads
19	IS	1458	Railway bronze ingots and castings
20	IS	2004	Carbon steel forgings for general engineering purposes
21	IS	2016	Specification for plain washers
22	IS	2031	Driving and driven machines - Shaft heights
23	IS	2048	Specification for parallel keys and keyways
24	IS	2073	carbon steel black bars for production of machine parts for general engineering purposes
25	IS	2102	(All 2 Parts) General tolerance Part 1 Tolerance for linear and angular dimensions without individual tolerance indications Part 2 Geometrical tolerance for features without individual t tolerance indications
26	IS	2232	Specification for slotted castle nuts
27	IS	2269	Hexagon socket head cap screws
28	IS	2291	Specification Tangential keys and keyways
29	IS	2292	Specification for taper keys and keyways
30	IS	2293	Specification for gib-head keys and keyways
31	IS	2294	Specification for woodruff keys and keyways
32	IS	2327	Straight sided splines for cylindrical shafts with internal centering - Dimensions, tolerances and verification
33	IS	2388	Slotted grub screws
34	IS	2403	Short pitch transmission precision roller chains and chain wheels
35	IS	2494	(All 2 Parts)– V-Belts - Endless V-belts for industrial purpose - Specification
36	IS	2501	Solid drawn copper tubes for general engineering purposes - Specification
37	IS	2535	Basic rack and modules of cylindrical gears for general engineering and heavy engineering
38	IS	2637	Steel roller chains type S and C, attachments and chain wheels
39	IS	2644	High tensile steel castings
40	IS	2707	Carbon steel castings for surface hardening - Specification
41	IS	2708	1.5 Percent manganese steel castings for general engineering purposes
42	IS	3142	Pulleys, V-grooved pulleys for endless V-belts section Z, A, B. C. D and E and endless wedge belts section SPZ, SPA, SPB and SPC -

			Specification
43	IS	3444	Corrosion resistant high alloy steel and nickel base castings for general applications - Specification
44	IS	3542	Specification for extended pitch transmission precision roller chains and chain wheels
45	IS	3560	Specification for short pitch transmission precision bush chains and chain wheels
46	IS	3560	Specification for Short pitch transmission precision bush chains and chain wheels
47	IS	3600	(All 9 Parts)– Method of testing fusion welded joints and weld metal in steel
48	IS	3665	Dimensions for involute sided splines
49	IS	3681	Gears - Cylindrical Gears - Accuracies
50	IS	3688	Power transmission - Shafts - Dimensions for cylindrical and 1/10 conical shaft ends
51	IS	4206	Dimensions for nominal lengths and thread lengths for bolts, screws and studs
52	IS	4218	(All 6 Parts)– ISO metric screw threads
53	IS	4260	Recommended Practice for ultrasonic testing of butt welds in ferrous steel
54	IS	5037	Specification for basic rack and modules of straight bevel gears for general engineering and heavy engineering
55	IS	5334	Code of Practice for magnetic particle flaw detection of welds
56	IS	9550	Bright steel bars - Specifications
57	IS	9595	Metal arc welding of carbon and carbon manganese steels - Recommendation
58	IS	14329	Malleable iron castings
59	IS	15151	Belt drives - Pulleys and V-ribbed belts for industrial applications - PH, PJ, PK, PM and PM profiles : Dimensions

9. Make List

The following make list should be followed:-

Mechanical Items		
Sr. No.	**Items**	**Make (by)**
1	Bearing, Plummer blocks	KHK(Japan) / FYH(Japan)/ZNL
2	Transmission Chain	Ti – Diamond, Dong Bo (Korea), Renold (Rollon)
3	Coupler	Lovejoy / KTR / NMT/

4	Geared Motors for Modules	Kavitsu/ IC Bauer/MGM Varvel/ Bonfiglioli/ MCN/ Nord/SEW
5	Gearbox	Kavitsu/ IC Bauer/MGM Varvel/ Bonfiglioli/ MCN/ Nord/SEW
6	Wire Ropes	Usha Martin/ TATA/SAIL

10. Power Hydraulics

10.1 General

10.1.1. Some car parking equipment could be hydraulically Operated. The hydraulic equipment will consist of 3 systems: the hydraulic actuator, the hydraulic power pack and electrical controls.

10.1.2. The hydraulic actuator is either a cylinder or a motor. The actuator will consume the pressurized fluid and transform the same to a linear or rotary motion.

10.1.3. The hydraulic power pack will generate the pressurized fluid. It will consist of all or some of the following:

Pipe lines, Flexible hose, Pumps and Electric Motors, Direction Control Valves, Gate Valve, Check Valve, Restrictor Valve, Flow Control Valve, Reducing Valve, Relief Valve Reservoir, Accumulator, Air Breather, Filter, Strainer, Cooler, Pressure Gauge, Level Gauge, Thermometer, Pressure Switch, Hydraulic Fluid etc.

10.1.4. For remote actuation generally the valves are electrically controlled. The electrical controls again are actuated by programmable logic controllers (PLC) with computer monitoring.

10.2 Hydraulic Power System

10.2.1. The hydraulic Power System shall satisfy the following:

i. All hydraulic circuit elements should be generously sized.

ii. Minimize surge pressure using appropriately sized accumulators

iii. The size of all components shall be selected to withstand the highest surge pressure.

iv. With a view to reduced heat generation, the system should be Operating for the required period only with a small margin of time during cut-off and also for recharging the accumulators. The temperature of the hydraulic fluid shall not be permitted to rise beyond 50^0 C. Considering the ambience, if required, coolers may be used.

v. Incorporate necessary connections, valves and appurtenances to facilitate air purging, testing, pickling, flushing, draining, sampling and re-commissioning the system.

vi. Provisions to reduce the risk of ignition of the hydraulic fluid.

vii. The selection of the type of pump will depend on the service condition.

viii. The working volume of the reservoir must be adequate.

ix. The return and suction pipes in the reservoir shall be located as far away as possible with a baffle wall in between.

x. The bottom of the reservoir shall be sloped for easy draining.

xi. The reservoir shall have a suitably protected thermometer. There shall be provisions for high & low temperature alarms.

xii. There shall be a flush mounted fluid level indicator for the reservoir.

xiii. The total flow rate of the pumps should have adequate margin over the design flow rate.

xiv. Provision of stand by pump should be made.

xv. Pumps shall be provided with isolation valves on both suction and delivery side to facilitate maintenance.

xvi. All directional valves shall be sub plate mounted on suitable valve stand or ease of Operation and maintenance.

xvii. Proportional and servo valves shall be provided with electronic card and cardholder. Necessary test kit shall be provided for proportional and servo valves.

xviii. Solenoid Operated valves shall incorporate the following features:

- Suitably sealed to avoid splashing liquid and airborne contaminant
- Manual override, which can be Operated without removing the cover but cannot be Operated accidentally.
- Solenoids shall be continuous duty type, Operating on 24 V DC.

xix. All accumulators shall preferably be bladder type and charged with nitrogen / inert gas. The size of the accumulator should satisfy the functional needs. The design pressure shall at least be 1.5 times the nominal design pressure.

xx. Before removing the accumulator from the system, the gas and fluid shall be released from the same. Arrangement shall be provided in the accumulator for this purpose. Manual bleeding and shut off valve shall be provided. Suitable charging device shall be provided. The accumulator shall be provided with safety relief valve and pressure gauge.

xxi. The cylinder body, heads and flanges shall be of steel. The cushion adjusting screws shall be stainless steel. Bleed valves are to be provided at both ends of the cylinder. Arrangement should be made to make the cylinder and cylinder head joint leak proof.

xxii. The piston shall be bronze or bronze coated steel. In the later case the minimum bronze coating thickness after machining will be 2.5 mm. Piston rods shall be high yield strength steel with hard chrome plating to 40~50 micron thickness, with 0.25 rms surface finish. The piston rod shall have wrench flats for the ease of tightening with the piston.

xxiii. The hydraulic motor selection shall incorporate the following features:

- The hydraulic motor shall be designed to meet 1.25 times the maximum system pressure at full flow rate.
- Possibility of over-running and complete stalling of the motor is present, suitable relief arrangement shall be provided to allow the oil to circuit without overheating.
- Where the hydraulic motor is required to rotate in both directions, arrangement shall be made for smooth change of direction.

xxiv. Hydraulic system shall b provided with pressure filter, circulation filter and return line filter of 3 micron, 5 micron and 10 micron respectively. The size shall be chosen to handle at least 100% of the rated capacity of the pumps. The filters shall have differential pressure switch to provide audiovisual signal indicating clogging.

xxv. The pipelines shall have minimum bursting pressure of 5 times the maximum working pressure. Fluid velocity in the pipeline shall be near about 4 m/s.

xxvi. Interlocks shall be provided to keep the system Operating.

xxvii. Positive position stop shall be provided so that the dwell time will not be affected when the position stops are reset.

xxviii. The hydraulic power system shall have built in safety in all areas.

10.3 Standards

The following Standards are applicable to power hydraulic system. However this list is not exhaustive:

1	IS	635	Specification for oil and solvent resistant hose of rubber
2	IS	7651	Wire reinforced rubber covered hydraulic hose- Specification
3	IS	8208	Sizes for cylinder bores and piston rod diameter for fluid power systems
4	IS	9269	Evaluation of pressure drops versus flow characteristics of hydraulic filter elements and filters - Method of test
5	IS	10531	Code of Practice for selection and use of fire resistant hydraulic fluids
6	IS	10532	(All of 4 Parts) Specification for fire resistant hydraulic fluids Hydraulic
7	IS	10660	Specification for rubber hydraulic hose with textile reinforcement
8	IS	11003	(All of 2 Parts) Recommendations for mounting dimensions for hydraulic fluid power - single rod cylinders, 160 bar medium series - bore -50 to 500 mm

9	IS	11146	Hydraulic fluid power - Cylinders - Bore and rod area ratios
10	IS	11147	Recommendations for parameter definitions and letter symbols for hydraulic fluid power pumps, motors and integral transmissions
11	IS	11277	Recommendations for characteristic quantities and designation of hydraulic fluid power gas loaded accumulators with separators
12	IS	11337	Purchase specification for hydraulic cylinders
13	IS	11559	Hydraulic fluid power - Cylinders - Rod end spherical eyes - mounting dimensions
14	IS	11560	Hydraulic fluid power - Cylinders - Rod end plain eyes - mounting dimensions
15	IS	12092	Method of hose assembly used in hydraulic fluid power system
16	IS	13053	Hydraulic fluid power system - Commissioning and maintenance of complete hydraulic systems
17	IS	13102	Hydraulic fluid power - Single rod cylinders 250 bar (25 Mpa) series - Port dimensions
18	IS	13103	Hydraulic fluid power - Single rod cylinders 160 bar (16 Mpa) compact series - Port dimensions
19	IS	13614	(All of 2 Parts) Hydraulic fluid power - Quick action couplings
20	IS	13614	Hydraulic couplings quick action
21	IS	14130	Hydraulic Lifting table - Specification
22	IS	14148	Hydraulic fluid power - Pressure control valves (excluding pressure relief valves), sequence valves, unloading valves, throttle valves and check valves - Mounting surfaces
23	IS	14645	Fluid power systems and components - Cylinders - Nominal pressures
24	IS	14671	Code of Practice for installation and maintenance of hydraulic lifts
25	IS	14848	Hydraulic fluid power - Pumps and motors - Geometric displacements
26	IS	14849	(All of 2 Parts) Hydraulic fluid power - Determination of characteristics of motors
27	IS	15168	Fluid power systems and components - Cylinders - Identification code for mounting dimension and mounting types
28	IS	15170	Hydraulic fluid power - Methods for cleaning and assessing the cleanliness level of components
29	IS	15178	Hydraulic fluid power - Fire resistant fluids - Guide lines for use
30	IS	15179	Hydraulic fluid power - Compatibility between elastomeric material and fluids
31	IS	15181	(All of 2 Parts) Hydraulic fluid power - Measurement techniques

C SPECIFICATION OF WORKS FOR ELECTRICAL COMPONENTS AND HVAC (HEATING, VENTILATION AND AIR CONDITIONING SYSTEM)

The Technical Specifications in accordance with which the entire work described hereinafter shall be constructed and completed by the Contractor within the quoted rates are given in this section. Specifications given are in accordance with the specifications / requirements indicated in Indian Electricity Act 2003 and Local Power Authority rules and regulations.

11. 11 KV H.T. PANEL

11.1 Principle Technical Requirement

Unless otherwise specified elsewhere in this specification, the rating, performance and testing of the indoor 11kV switchgear and accessories shall conform to latest revision, of following Indian standard/IEC:

IEC / IS	Description
IEC 62271-100	AC high voltage alternating current circuit breaker
IEC 62271-001	Common specification for High Voltage Switchgear and Control gear standards.
IEC 60694	Common clause for high voltage switchgear & control-gear standards
IS 12729	General requirements for Switchgear and Control gear for voltages exceeding 1000V.
IS 13118	General requirements for Circuit Breakers for voltages above 1000V.
IS 9920	High voltage switches
IEC 60044-1	Current transformer
IEC 60044-6	Current transformer
IS 2705	Current transformer
IS 4201	Application guide for current transformer
IEC 60044-2	Voltage transformer
IS 3156	Voltage transformer
IS 4146	Application guide for voltage transformer
IEC 60270	Partial discharge measurement.
IS 6209	Methods for partial discharge measurement.
IEC 60137	Bushing for alternating voltage above 1000 V
IS 2099	Specification for bushing for alternating voltage above 1.1 kV.
IEC 60427	Synthetic testing of high voltage AC circuit breaker
IEC 60071	Insulation co-ordination
IEC 60270	Partial discharge measurement
IS 4146	Application guide for voltage transformer

IEC 60255	Electrical Relay
IS 3231	Specification for electric relays for power system protection
IS 3842	Application guidance for electric relays for AC system
IS 1248	Electrical Indicating instruments
IS 0722	Energy meter
IS 6875	Control switches & push buttons

The components & devices which are not covered by the above standards shall conform to, and comply with the latest applicable standards, rules, codes & regulations of the Indian or international recognized standardizing body. The contractor / agency should provide all applicable standards, codes, etc. to the Engineer / Employer for their reference.

11.2 Service conditions

a. The switchgear shall be capable of Operating normally within the following temperature range:
   - Maximum air temperature: + 55 ° C
   - Minimum air temperature: + 1 ° C

b. The switchgear shall be capable of being Operated in electrically exposed locations.

c. The switchgear shall be capable of Operating normally within the following relative Humidity
   - Max. average relative humidity measured over 24 Hrs :- 95 %
   - Max. average relative humidity measured over 1 Month :- 90 %

d. The switchgear shall be suitable for indoor installations with the following levels of ingress protection:
   - Insulating medium envelope no less than IP55.
   - Panel's exterior housing not less than IP54 (main door shut).
   - Panel's exterior housing not less than IP41 (main door open).

11.3 Switchgear for 11 KV HT panel

Sr. No.	Description	Qty
1.	Draw out type 11kV, 2000A, 50KA motorized ACB	As per design approved by the Engineer / Employer
2.	Current transformer of ratio for each Breaker Core 1 protection class, ratio 630/5A Burden 20VA accuracy 5P 20 Core 2 protection class, ratio 630/5A Burden 40VA accuracy PS Core 3 protection class, ratio 630/5A Burden 20VA accuracy 5P 20 Core 4 metering class, ratio 630/5A	

Sr. No.	Description	Qty
	Burden 20VA accuracy 0.5	
3.	Potential transformer for breaker 11kV/√3 /110V/√3, 30VA, C.L.1.0	
4.	Instruments suitable for Breaker Voltmeter 0-12kV digital type with selector switch Digital Multifunction Meter	
5.	Breaker control switch (Last motion type) / each breaker	
6.	Circuit breaker position indication lamps/ each breaker	
7.	Voltage indication lamps/ each PT	
8.	Indication lamp for on and off on each breaker	
9.	Indication lamp for spring charge on each breaker	
10.	Indication lamp for protection trip on each breaker	
11.	Indication lamp for trip circuit healthy on each breaker	
12.	Indication for test and service position on each breaker	
13.	Push button for Emergency Trip on each breaker	
14.	Ammeter selector switch stay put type each breaker	
15.	Microprocessor based over current and earth fault relay with instantaneous and time unit on breaker	
16.	Microprocessor based Directional over current relay with instantaneous and time unit on breaker	
17.	Microprocessor based transformer differential relay, trip circuit supervision relay on breaker	
18.	Master Trip relay per breaker	
19.	Space heater with thermostat per breaker	
20.	C.F. lamp for panel illumination	
21.	Receptacle for each panel	
22.	'48 Volts DC failure' alarm	
23.	220 V AC hooters for non trip	
24.	Relay for DC failure	
25.	Annunciator on each breaker	

12. D.G SET

12.1 This specification covers the requirements of design, manufacture, assembly, testing, packing and forwarding, transportation, erection and commissioning of following DG Set:

- 2Nos. of adequate capacity ,

- 440 / 415V D.G. Set (Outdoor) with base frame,
- Battery & battery charger & fuel tank.

a) D.G control panels with required switchgear & protection. Generator control unit (GCU) shall be included in panel to provide control for AMF & Synchronous Operation.
b) Acoustics enclosure should be provided to restrict the vibration level to 70db at 1mtr distance from the DG set. HSD day tank of sufficient capacity should be provided with level glass tube.
c) Flue gas ducting with silencer in IS 2002, 6mm thick. (Or A106 Gr. B., Sch 40) SS 304 below, lightly resin branded mineral wool, 100mm thick with 22g Aluminum cladding and exhaust chimney. Length of chimney shall be as per local regulations.
d) All statutory approvals such as local supply co. and pollution control board NOC and approval of electrical inspector for installation drawings and installation work from Electricity Department, Pollution Control Board etc.
e) Earthing grid for DG and panel, earth pits in scope of contract.
f) All civil work, power cabling etc. shall be in scope of contract.
g) All piping / hose between Day tank and DG set.
h) AVM pads (gel filled) for engine and alternator frame mounting.

12.2 Format of Data Sheet for DG Set

Sr. No.	Description	To be filled in by contractor
1.	**Diesel Engine**	
a)	Make	**
b)	Model no.	**
c)	Bore / Stroke / Mean piston speed /No. of cylinders	**
d)	Fuel Consumption in Gm/BHP/hr. & liters/hr	
i.	At 100% load in gm/BHP/hr.	**
ii.	At 75% load in gm/BHP/hr.	**
iii.	At 50% load in gm/BHP/hr.	**
iv.	At 100% load in ltrs./ hr.	**
v.	At 75% load in ltrs./ hr.	**
vi.	At 50% load in ltrs./ hr.	**
e)	Lube Oil Consumption (liters/hr.)	**
f)	Frequency of lube oil replacement	**
g)	Coolant conditioner consumption	**
h)	Frequency of corrosion resistor replacement	**
i)	Power availability at Generator terminals (units/liter of HSD)	**
j)	Specific gravity & calorific value of HSD considered for Fuel	**
k)	Type of AMF controller and Technical details.	**
l)	Cooling Water requirement:	
i.	Inlet temperature	**
ii.	Outlet temperature ^{o}C	**
iii.	Water flow required in Ltr/min	**
iv.	Heat load Ton	**

Sr. No.	Description	To be filled in by contractor
v.	Ventilation requirement (water)	**
2.	**Alternator**	
a)	Make	**
b)	Model	**
c)	Enclosure Air cooled IP protection class	**
d)	Insulation class F/F	**
e)	Temperature sensor for bearings	**
f)	Temperature sensor for windings	**
g)	Anti-condensation standstill heaters – Voltage: 220V AC	**
h)	Tropical/Humidity Protection	**
i)	Voltage regulator	**
3.	**Protection Relays**	**
4.	**Acoustic Enclosure**	
a)	Weatherproof, metallic, sound attenuated	**
b)	Noise level to be maintained at a level of less than 72 dB.	**
c)	Self supporting structure	**
d)	Normal regular conversation possible at a distance of 1.0 mtr. from the enclosure	**
e)	Residential silencer with suitable lagging	**
f)	Warranty offered for weather proof enclosure	**
g)	Overall Dimension layout with clearances with respect to DG set shall be provided	**
5.	**Battery & Battery Chargers**	
1.	Battery	
1.	Make	**
2.	Type	**
3.	Voltage	**
2.	Battery Charger	
	- AH capacity	**
6.	**Maintenance**	
a)	Spares/consumables list for one year trouble free Operation after warranty period.	**
b)	Maintenance schedule incorporating normal/major maintenance & shut down requirements.	**

Note: ** Data to be filled by contractor.

13. Earth Mat Design

Provision of adequate earthing system in a Substation is extremely important for the safety of the Operating personnel as well as for proper system Operation and performance of the protective devices. The primary requirements of a good earthing system in a Sub Station are:

a) The impedance to ground should be as low as possible but it should not exceed 1.0 (ONE) Ohm.

b) The step Potential, which is the maximum value of the potential difference possible of being shunted by a human body between two accessible points on the ground separated by the distance of one pace (which may be assumed to be one metre), should be within safe limits

c) Touch Potential, which is the maximum value of potential difference between a point on the ground and a point on an object likely to carry fault current such that the points can be touched by a person, should also be within safe limits.

To meet these requirements, an earthed system comprising of an earthing mat buried at a suitable depth below ground and supplemented with ground rods at suitable points is provided in the Sub Stations.

All the structures & equipments in the Sub Station are connected to the earthing mat so as to ensure that under fault conditions, none of these parts is at a potential higher than that of the earthing mat.

The neutral points of different voltage levels of transformers & reactors are separately earthed at two different points. Each of these earthed points should be interconnected with the station earthing mat.

14. DC Substation Battery

This covers the supplying, erecting and commissioning of 48V partial recombination type Nickel-Cadmium alkaline batteries sub-stations.
The batteries covered in this specification are for indoor use.
DC system shall consist of 2 battery charger & 2 battery sets.

15. Applicable Standards

All standards, specifications and codes of practice referred to herein shall be the latest editions including all applicable official amendments and revisions as on date of opening of bid. In case of conflict between this specification and those (IS codes, standards etc.) referred to herein, the former shall prevail. Unless otherwise modified in this specification, the Ni-Cd batteries shall comply with latest version of lEC 62259.
All the work shall be carried out as per the following standards and codes.

Sr. No.	International Standards	Indian Standards	Description
1.	lEC: 62259	-	Secondary cells and batteries containing alkaline or other non-acid electrolytes-Nickel-cadmium prismatic secondary single cells with partial gas recombination
2.	lEC: 60623	IS: 10918	Secondary cells and batteries containing alkaline or other non-acid electrolytes-vented Nickel Cadmium prismatic rechargeable single cells
3.		IS: 1146	Rubber & Plastic container for lead acid storage batteries

Sr. No.	International Standards	Indian Standards	Description
4.	IEEE: 1106		Recommended practice for maintenance, testing & replacement of Ni-Cd storage batteries for generating stations & substations
5.	IEEE: 1115		Recommended practice for sizing of Ni-Cd batteries for stationary applications
6.		IS: 13140	Glass reinforced Polyster sheet moulding compounds
7.		IS: 1248	Voltmeter
8		IS: 5	Colours for ready mix paints.
8.		IS: 1248	Specification for Direct acting indicating analogue electrical measuring instruments.
9.	IEC : 947-1	IS: 13947 Prt-l	Degree of protection provided by enclosures for low voltage switch gear and control gear.
10.	IEC : 947-2	IS: 13947 Prt.-2	Low voltage circuit breaker
11.	IEC : 947-3	IS : 13947 Prt-3	Specification for low voltage switch gear and control gear
12.	IEC : 947-4	IS : 13947 Prt-4	Contractors
13.	IEC:439	IS:8623	Low voltage switch-gear and control-gear assembly
14.		IS: 8686	Static protective relays
15.	IEC: 337	IS:6875	Control switches
16.	IEC:225	IS: 3231	Electrical relays for power system protection.
1.		IS : 3842	Application guide for Electrical relays for AC System
2.	IEC 146	IS : 3895	Mono-crystalline semi-conductor Rectifier Cells and Stacks.
3.	IEC 146	IS: 4540	Mono crystalline semi-conductor Rectifier assemblies and equipment.
4.		IS:6619	Safety Code for Semi-conductor Rectifier Equipment.
5.		IS: 6875	Control switches (switching devices for control and auxiliary circuits including contactor relays) for voltages upto 1000 V AC or 1200 VDC.
6.		IS: 9000	Basic environmental testing procedures for electronic and electrical items.
7.	IEC:60269	IS:13703 Prt-4	Low voltage fuses for protection of semiconductor devices.
8.		IS:1901	Visual indicating lamps
9.		IS:6005	Code of practice for phosphating Iron and Steel
10.	IEC :227	IS:694 lS: 1554	PVC Insulated Cable for working voltages upto and including 1100 V.

Equipment complying with other internationally accepted standards such as IEC, BS etc. will also be considered if they ensure performance and constructional features equivalent or superior to standards listed above. In such a case, the contractor shall clearly indicate the standard(s) adopted, furnish a copy in English of the latest revision of the standards along with copies of all official amendments and revisions in force and shall clearly bring out the salient features for comparison.

16. DC Distribution Panel

16.1 Specification

This section sets out the scope of the work covered by this specification as well as required supplies and services and includes other necessary components and services not specifically mentioned.

a) 20% of each size of electrical components, used in DC distribution panel, as spares required for Ten (10) years of trouble free Operation. Spares list to be provided by bidder.
b) All necessary base frames, channels and all erection hardware

16.2 Technical requirements

The equipment shall be indoor type, suitable for inter-connection with battery & DC Distribution Panel.

16.3 Standard

The design, engineering, quality surveillance, manufacturing and testing of various equipments covered in this specification shall comply with latest edition of following standards.

Sr. No.	Description	IS
1.	Switchgear bus bars and bus bar connections	IS-375/ BS-159
2.	Degree of Protection Provided by enclosures for LV switchgear	IS-2147
3.	PVC Insulated Cables	IS-1554
4.	General requirement for switch-gear and control gear	IS-4237
5.	For voltage not exceeding 1000 V	IS-3202
6.	Code of practice for climate proofing of electrical equipment	IS-6005
7.	Code of Practice for phosphating Iron and Steel	IS-1108
8.	HRC Cartridge fuses links upto 650 V.	IS-8623

17. Low Voltage Panels / APFC Panel

17.1 Specification

These specifications cover the design, material selection, manufacture, testing at manufacturer's works, insurance, packing, transportation, loading/unloading, supply at site, installation, testing and commissioning of the low voltage panels / APFC panels covered in the BOQ, for indoor / outdoor installation.

17.2 Codes and Standards

Some of the important applicable codes/ standards issued by the Bureau of Indian Standards are listed below for the guidance of the Tenderers. Latest issues of the standards/codes shall be applicable:

IS: 13947	:	L.V. switchgear and control gear Part-I – 1993 Generall rules
IS: 5578	:	Guide for marking of insulated conductors
IS: 11353	:	Guide for uniform system of marking and identification of conductors and apparatus terminals
IS: 2147	:	Degree of protection provided by enclosures for low voltage switchgear and control gears
IS: 2675	:	Enclosed distribution fuse boards and cutouts for Voltages not exceeding 1000 V
IS: 255	:	Danger notice plates
IEC60947	:	Circuit Breakers (Part- II)
IEC60947	:	Circuit breakers (Part-II)
IS: 13947	:	Switches, Disconnectors, switch disconnector (Part - III) and fuse combination units.
IS: 1818	:	Alternating current isolators (disconnectors) and earthing switches.
IS: 8623	:	Factory built assembles of switchgear and control gear for voltages upto and including 1000 V AC & 1200 V DC.
IS: 8828	:	Miniature air break circuit breakers for voltages not exceeding 1000 V
IS: 9926	:	Fuse wires used in rewirable type Electric fuses upto 1100 Volts
IS: 2208	:	HRC fuse links
IS: 2705	:	Current Transformers (Part- I, II & III)
IS: 3156	:	Voltage Transformers (Part- I, II & III)
IS: 1248	:	Indicating Instruments
IS: 722	:	Integrating Instruments
IEC 60947 / IS: 13947	:	Control devices and switching elements (Part - 5) Section-1
IEC60947/ IS: 13947	:	Contactors and motor starter section 1 (Part - 4) Electromechanical. Section - 1
IS: 3231	:	Relays
IS: 375	:	Marking and arrangement of busbarsIndian Electricity Act and Rules

17.3 System Rating

All the Main Panels / Motor control centres / APFC panels shall be suitable for Operation on three phase/ single phase, 415/230 volts, 50 Hz neutral solidly grounded at transformer and short circuit level not less than 415 Volts at 35 KA / 25 KA.

All the Main Panels / Motor control centres / APFC panels shall be designed to withstand heaviest condition at site, with maximum expected ambient temperature of 45ºC, 90-95 percent humidity and dusty weather.

18. Distribution Boards

This specification shall cover the supply, installation, testing and commissioning of lighting and power distribution boards.

18.1 System

The MCB distribution boards shall be suitable for Operation on 415/440 volt, 3 phase, 4 wire, 50 Hz A.C. supply system or 220/250 volt, 1 phase, 2 / 3 wire, 50 Hz A.C. supply system.

18.2 Codes and Standards

Some of the important applicable codes/ standards issued by the Bureau of Indian Standards are listed below for the guidance of the Tenderers. Latest issues of the standards/codes shall be applicable:

1)	IS:2675-1983	Enclosed distribution fuse boards and cutouts for Voltages not exceeding 1000V.
2)	IS:375-1963	Marking and arrangement of Switchgear busbars main connec- tions and auxiliary wiring.
3)	IS:8828-1978	Miniature circuit Breakers
4)	IS:2607-1976	Air break Isolators for voltages not exceeding 1000V.
5)	IS:9926-1981	Fuse wire used in Rewirable type Electric fuses up to 650 volts.
6)	Electricity Act 1910 and rules issued there under.	

19. HT AVR (Stabilizer)

i) As this is a design built contract, the contractor must provide the required size of HT AVR as per the load requirement of the entire building through the transformer

ii) As this project involves semi automatic car parking systems, a three terminal voltage regulator is a must for voltage regulation.

iii) HT AVR must be suitable for indoor / outdoor installations.

iv) The Automatic Voltage Regulator must possess an automatic voltage regulation mechanism which stabilizes the voltage i.e. it must keep output voltage in steady state automatically when the power voltage fluctuates or the load current varies and must protect all the electrical equipments in the building from overloading.

v) These voltage regulators must also control the output of the entire building.

vi) These voltage regulators must be installed along distribution lines so that all the points receive steady voltage independent of how much power is drawn from the line.

vii) This automatic integrated circuit voltage regulator must be connected to the output of a filtered rectifier and must maintain a constant output voltage or current despite changes in the input, the load current, or the temperature.

viii) HT output must be within +/- 1% accuracy.

ix) HT AVR must possess large capacity, high efficiency, no wave distortion, stable voltage adjustment, suitability for kinds of loads, bearing instantaneous overload, working continually for long time, as well as free transferring between manual control and automatic control, etc,

x) This Automatic Voltage Regulator must be provided with protection against over-voltage, over current, phase failure and protection for phase sequence.

xi) Full wave bridge rectifier must be used to rectify the ac output of secondary of 230/12V step down transformer.

xii) HT AVR must have the following merits: small volume, light weight, convenient installation and reliable running.

xiii) The HT AVR system must be copper wound.

xiv) The fluctuating voltage must be initially controlled by the HT AVR and then fed to the transformer resulting in the constant H.T. Output within +/- 1% accuracy.

xv) The design of the HT AVR must be robust; thus resulting in lesser losses & more efficiency and making the distribution transformer to utilize up to 100% capacity.

xvi) HT AVR must work continuously for a long time without human attendance.

xvii) The design, engineering, quality surveillance, manufacturing and testing of these HT AVR shall comply with latest edition of ISO 9001:2008 / BIS standards / IS 9815-94 / IEC

xviii) HT AVR must be designed keeping in view the following parameters:

Working input voltage range	170-270 V, 50Hz	140-270 V, 50Hz	110-270 V, 50Hz	90-270 V, 50Hz
Output Voltage Range	As required and as per application generally in the range of +/- 10%, +/- 8%, +/- 5%, etc			
High / Low Cut - Off System	Must protect the Connected Equipment against dangerous high voltage and low voltage, cuts-off supply at dangerous zone			
Technology	IC based electronic circuits for High reliability and Self Protection			
Time Delay	Time delay circuit is to be provided to reduce surge currents and overloads during the switch on off at frequent intervals, thus the load is protected.			
TempGVSCCLture bearing capacity	Minus 5℃ to Plus 48℃			

xix) Following makes are recommended for HT AVR:

a) Servokon Systems Limited
b) Neopack Int'l (NEOPOWER DIV.)
c) Muskaan Power Infrastructure Ltd

d) ABB
e) Power Engineers Company
f) Bharti Electricals
g) Recons Power Equipments Pvt. Ltd

20. LT Cable

20.1 General

The scope of this specification covers manufacture, supply, inspection, testing at works, packing and forwarding of 1100V grade LT XLPE Power cables & installation including commissioning at site.

Cables shall be aluminium, XLPE insulated, PVC sheathed and round armoured of 3 / 3-½ core and 4 core of sizes specified and suitable for 230 / 415 volts, 1 / 3 phase 50 Hz power supply. The cables shall be suitable for the rated voltage 1100 volts conforming to IS 7098 with latest amendments.

Cables shall be of approved make only. Each drum or coil of cable shall be accompanied by a certificate stating the manufacturer's name, rating of cable, result, and date of tests.

All cables shall be delivered with cable ends effectively sealed. When a cable is cut from a drum both ends shall be immediately sealed to prevent ingress of moisture. Cables shall not be transported to site in loose coils but a number of short lengths of cable may be transported on the same drum. The Contractor shall be wholly responsible for the purchase and/or hire costs of all cable drums and for the removal of these drums from site after use.

Cables shall be adequately rated for current carrying capacity under normal and short time fault conditions at the specified voltage.

The voltage drop for any circuit from origin of the installation (i.e. supply authority's terminals) and the load under steady state conditions shall not exceed ±6% of the nominal voltage.

The Contractor shall submit cable schedules for approval detailing ratings, sizes, lengths, method of installation and function of all individual cables. Cables shall be laid in uncut / single lengths from one termination to the other.

All cables will be identified close to their termination point by cable numbers as per cable schedule. Cable numbers will be punched on aluminum straps (2 mm thick) securely fastened to the cable and wrapped around it. Alternatively cable tags shall be circular in construction to which cable numbers can be conveniently punched. Each underground cable shall be provided with identity tags of lead securely fastened every 30 M of its underground length with atleast one tag at each end before the cable enters the ground. Unpaved area, cable trenches shall be identified by means of markers as per standards.

20.2 Standards

The cables offered shall conform to the latest revision of relevant Indian Standard Specifications Some of these standard are list below

Sr No	Indian Standard	Title
1	7098	XLPE insulated electrical cables for working voltages upto 1100V
2	8130	Conductors for insulated electric cables and flexible cords.
3	5831	PVC insulation & Sheath of electric cables.
4	3975	Mild steel wires, strips and tapes for armouring of cables.
5	2633	Methods of testing weight, uniformity of coating, thickness on hot dip galvanised articales.
6	3961	Recommended current ratings for cables- PVC insulated and PVC sheathed.
7	1753	Aluminium conductors for insulators cables.

20.3 Termination

All XLPE cables upto 1.1KV grade shall be terminated at the equipments by means of cable glands. They shall have a screwed nipple with conduit electrical threads and check nut.

Cable leads shall be terminated at the equipment terminals, by means of crimped type lugs. When crimping the lug to the cable, proper crimping tool to suit the size of lug / cable is to be used.

21. Cable Trays / Raceway & Accessories

These specifications cover the design, material selection, fabrication, testing at manufacturer's works, insurance, packing, transportation, loading / unloading, supply at site and installation of cable trays, trunking (Raceway) and accessories covered herein.

21.1 Material and construction

Cable trays and accessories shall be manufactured to comply with the specifications of National Electrical Code (NEC) and National Electrical Manufacturers' Association (NEMA).

Cable trays and accessories shall be fabricated using mild steel sheets and hot dip galvanized in accordance with B.S.729 after fabrication. All bolts, nuts and washers shall also be galvanized. The zinc coating shall be uniform, smooth and free from imperfections such as flux & ash, black spots, blisters etc. Cable trays and accessories shall undergo a process of degreasing, pickling in acid & cold rinsing prior to galvanisation.
Cable trays shall be of the following type:

i. Ladder type with rungs
ii. Perforated type.

Perforated cable trays shall be generally of channel type and the perforations shall be 10x30 mm oval holes. Perforated cable trays shall also be galvanised. Galvanising shall be in accordance with that specified above for ladder type cable tray.
Ladder type cable trays shall be made from 2mm thick sheet formed in `C' section of 75mm height and inward flanges of 15mm as side runners and 30mm wide x 10mm high rungs (`C' shaped) from a 1.5mm thick sheet. Perforations as mentioned above shall be provided in the width of the rungs. Pitch of the rungs shall not exceed 250 mm center to centre. Rungs shall be tack welded to the side members.

The thickness of sheet steel for perforated trays shall be 1.6 mm and they shall be of the formed channel shape.
Cable trays shall be of following dimensions as specified in BOQ.

21.2 Accessories

Following accessories and hardware, as required, shall be supplied with cable trays :

- Coupler plates
- bends
- Tees
- Reducers
- 4-way cross
- Fasteners (Hardware)

21.3 Testing at manufacturers' work

The material for cable trays and accessories shall be offered for stage inspection of the Engineer / Employer as follows:

- Prior to fabrication and galvanising.
- After fabrication but before galvanising.
- After galvanising but prior to dispatch.

During inspection, thickness of sheets, dimensions and weight of zinc coating will be measured. Items not conforming to specifications shall be rejected.
Prior to fabrication, sheets to be used for fabrication of trunking/accessories shall be offered for inspection. Subsequent to fabrication, but prior to galvanising, trunking/accessories shall be offered for inspection. Items not conforming to specifications shall be rejected.

22. Wiring System

This section covers providing & commissioning of wiring system for lights, fans, exhaust fans, power sockets etc. The wiring shall generally be carried out using 1.1 KV grade PVC insulated stranded copper conductors FRLS wires in rigid PVC conduit laid on surface or concealed complete with insulated earth wire, flushed modular switches, sockets etc.

22.1 Standards

The installation shall conform in all respects to Indian Standard Code of Practice for Electrical wiring installation IS:732-1963 and IS:2274-1963. It shall also be in conformity with Indian Electricity Rules and the Regulations, National Electric Code and National Building Code, CPWD specifications and requirements of the Local Electric Supply Authority. In general, all materials, equipment and workmanship shall conform to the Indian Standards, specifications and code. Some of the applicable codes/standards are as under:

IS 375	Marking and arrangements for switchgear : Bus bars, main connection and auxiliary wiring

IS 2675	Specifications for enclosed distribution
IS 1554	Specifications for PVC insulated (heavy duty) electric cable Part-I for voltage upto 1100 volts.
IS 694	Specifications for PVC insulated: Cables for voltage upto 1100V with Aluminium conductors.
IS 5133	Boxes for the enclosure of electrical accessories
IS 1293	3 pin plugs and socket outlets
IS 1913	General and safety requirements for electric lighting fittings.
IS 374	Electric ceiling fans and regulators.
IS 3043	Code of practice for earthing IS 3043
IS 1646	Electrical installation.
IS 8623	Factory built assemblies of switch gear & control gear.

22.2 Distribution Wiring Systems

22.2.1 General

The wiring systems should be suitable for the following systems depending on the requirement.

i. 3 phase, 4 wire, 440V, 50 Hz, AC.
ii. Single phase, 2/3 wire, 240V, 50 Hz, AC

22.2.2 Wiring systems

Depending on the requirement, the following systems are covered by this specification.
Concealed / Exposed systems using conduits laid / surface mounted in / on slabs, beams, walls, flooring etc. The conduits should be of heavy duty rigid PVC.

22.2.3 Installation

The size of conduit shall be selected in accordance with the number of wires permitted under table given below. The minimum size of the conduit shall be 20 mm Dia unless otherwise indicated or approved. Size of wires shall be as specified in the schedule of work / SLD.

Nominal dia of wires (mm)	Nominal Cross sec. area (sqmm)	20 S	mm B	25 S	mm B	32 S	mm B	38 S	mm B
1/2.40	1.50	4	3	8	6	15	9	-	-
1/1.80	2.50	4	2	6	4	10	8	-	-
1/2.24	4.00	2	2	4	3	8	6	-	-
1/2.80	6.00	1	-	4	3	6	6	-	-
1/3.55	10.00	1	-	3	2	5	4	6	5

a) S- runs of conduits which have distance not exceeding 4.25 m between draw boxes & which do not deflect from the straight by an angle more than 15 degree.
b) B- runs of conduits, which have, deflect from the straight by more than 15 degree.
c) Conduits shall be kept at a minimum of 100 mm from the pipes of other non-electrical services.

Separate conduits shall be used for each of the following:

- Normal lights and 6A 3 pin sockets on lighting circuit
- Power outlets - 16A 6 pin socket
- Emergency lighting
- Telephones
- Data outlets
- Fire alarm system
- Public address system
- Call bell wiring
- CCTV system
- Access Control

Conduit layout shall be as approved of the Engineer. Wiring for short extensions to outlets in hung ceiling or to vibrating equipments, motors etc., shall be installed in flexible conduits. Otherwise rigid conduits shall be used. No flexible extension shall exceed 1.25m.

22.3 Point Wiring

22.3.1 11.3.1 Definition

A point shall include all work necessary in complete wiring to the following outlets from the controlling switch or MCB.

a. Ceiling rose or connector (in the case of points for ceiling / exhaust fan points, prewired light fittings, and call bells).
b. Ceiling rose (in case of pendants except stiff pendants).
c. Back plate (in the case of stiff pendants).
d. Lamp holder (in the case of goose neck type wall brackets, batten holders and fittings which are not prewired).

22.3.2 Point wiring (Other than socket outlet points)

a. Unless and otherwise specified, there shall be no linear measurement for point wiring for light points, fan points, exhaust fan points, call bell points and power point. These shall be measured on unit basis by counting.

22.3.3 Point wiring for socket outlet points:

a. The light (6A) point and power (16A) point wiring shall be measured on linear basis, from the respective tapping point of live cable, namely, switch box, another socket outlet point, or the sub distribution board as the case maybe, up to the socket outlet.

b. The metal/PVC box with cover, switch/MCB, socket outlet and other accessories shall be measured and paid as a separate item.

Note: There shall normally be no "on the board" light plug point.

c. The power point outlet may be 16A/6 A six pin socket outlet, where so specified in the tender documents.

22.3.4 Group Control point wiring:

a. In the case of points with more than one point controlled by the same switch, such points shall be measured in parts i.e. (a) from the DB to switch board & the switch to the first point outlet as one point (Primary point)and for the subsequent points, the distance from that outlet to the next one and so on, shall be treated as separate point (Secondary point)

b. No recovery shall be made for non-provision of more than one switch in such cases.

22.3.5 Socket Outlets:

i. Socket outlets shall be 6A 3 pin, 16 Amp 3 pin or 16/6 Amp 6 pin. 5 pin socket outlets will not be permitted. The third pin shall be connected to earth through protective (loop earthing) conductor, 2 pin or 5 pin sockets shall not be permitted to be used.

ii. Conductors connecting electrical appliances with socket outlets shall be of flexible type with an earthing conductor for connection to the earth terminal of plug and the metallic body of the electrical appliance.

iii. Sockets for the power outlets of rating above 1 KW shall be of industrial type with associated plug top and controlling MCB.

iv. Where specified, shutter type (interlocking type) of sockets shall be used.

v. Every socket outlet shall be controlled by a switch or MCB, as specified. The control switch/MCB shall be connected on the `live' side of the line.

vi. 5A/6A and 15A/ 16A socket outlets shall be installed at the following positions, unless otherwise specified.

a. Non-residential buildings - 23cm above floor level.

b. Kitchen - 23 cm above working platform and away from the likely positions of stove and sink. Bathroom - No socket outlet is permitted for connecting a portable appliance

thereto. MCB/IC switch may be provided above 2 m for fixed appliances, and at least 1 m away from shower.

c. Rooms in residences - 23 cm above floor level, or any other level in special cases as desired by the Engineer-in-charge.

d. Unless and otherwise specified, the control switches for the 6A and 16A socket outlets shall be kept along with the socket outlets.

22.4 Submain & Circuit (Mains) wiring:

a. Submain wiring:

Submain wiring shall mean the wiring from one main/distribution switchboard to another.

b. Circuit(Mains) wiring:

Circuit wiring shall mean the wiring from the distribution board to the tapping point inside the switch box, from where point wiring starts.

c. Wiring System:

i. Wiring shall be done only by the looping system. Phase/live conductors shall be looped at the switch box. For point wiring, neutral wire/earth wire looping for the 1 st point shall be done in the switch box; and neutral/earth looping of subsequent points will be made from point outlets.
ii. In wiring, no joints in wiring will be permitted anywhere, except in switch box or point outlets, where jointing of wires will be allowed with use of suitable connector.
iii. The wiring throughout the installation shall be such that there is no break in the neutral wire except in the form of linked switchgear.
iv. Colour coding:-

Following colour coding shall be followed in wiring:-

Phase	:	Red/Yellow/Blue.(Three phase wiring)
Live	:	Red (Single phase wiring)
Neutral	:	Black
Earth	:	Green.

v. Termination of circuit into switchboard:-

Circuit will consist of phase/neutral/earth wire. Circuit will terminate in a switch board in following manner:-

Phase wire terminated in phase connector. Neutral wire terminated in neutral connector. Earth wire, terminated in earth connector.

The switchboard will have phase neutral and earth terminal connector blocks to receive phase/ neutral/earth wire.

22.5 Lighting Fixtures

This shall cover the supply, installation and testing of various types of light fixtures. This also includes specifications to be followed for supply of heavy duty exhaust fans and ceiling fans.

22.5.1 Standards

The following standards and rules shall be applicable :

IS 3646	-	1960 Code of practice for interior illuminator.
IS 1913	-	1969 General and Safety requirements for electric lighting fittings.

Indian Electricity Act and Rules issued there under.

All codes and standards mean the latest. Where not specified otherwise the installation shall generally follow the Indian Standard Code of Practice or the relevant British Standard Code of Practice in the absence of Indian Standard.

22.5.2 General Requirements

a) Fixtures and lamps shall be as per the catalogue number, where indicated in the bill of quantity.

b) Fixtures and lamps shall be provided with such accessories as are required to satisfy the working condition whether specifically mentioned in the specifications, drawings or not.

c) The fixtures shall be provided with power factor improvement capacitors, as applicable, to improve the power factor upto 0.9 lag.

d) All fixtures shall be complete with accessories and fixings necessary for installation whether so detailed under fixture description or not.

e) Fixture housing, frame or canopy shall provide a suitable cover for the fixture outlet box of fixture opening.

f) Fixture shall be installed at mounting heights as detailed on the drawings or instructed on site by the client's representative.

g) Fixtures and/or fixture outlet boxes shall be provided with hangers to adequately support the complete weight of the fixture. Design of hangers and method of fastening specified shall be submitted to the client's representative for approval.

h) Fixture shall be completely wired and constructed to comply with the regulations and standards for Electric Lighting Fixtures, unless otherwise specified. Fixtures shall bear manufacturer's name and the factory inspection label unless otherwise approved.

i) Wiring within the fixture and for connection to the branch circuit wiring shall be not less than 1.5 sq. mm. copper for 250 Volt applications. Wire insulation shall suit the temperature conditions inside the fixture and wires bypassing the choke shall be heat protected with a heat resistant sleeve.

j) Metal used in lighting fixtures shall be not less than 22 SWG or heavier if so required to comply with specifications or standards. Sheet steel reflectors shall have a thickness of not less than 20 SWG. The metal parts of the fixtures shall be completely free from burrs and tool marks. Solder shall not be used as mechanical fastening device on any parts of the fixture.

k) Ferrous metal shall be galvanized and given a corrosion resistant phosphate treatment or other approved rust inhibiting prim coat to provide a rust-proof base before application of finish.

l) Non-reflecting surfaces such as fixture frames and trim shall be Aluminum die cast.

m) All the fixtures are as per the IP - 54 insulation class or specified .

n) Lighting fixtures shall be designed for minimum glare and for continuous Operation under specified atmospheric condition.

o) All fixtures shall be complete with accessories like power factor improvement capacitors, ballast, ignitor etc.

p) Fluorescent fixture shall be of sheet steel casing with corrosion resistance finish. It shall be provided with separate wiring channel with cover plate and an earth terminal. All screw shall be chromium brass only. Lamp and starter holders shall be of tough molded plastic with spring loaded rotor type connector. Condensers shall be low loss paper impregnated hermetically sealed. Internal wiring shall be neatly clipped and where by passing the ballast, a suitable heat resistance barrier or sleeve shall be provided.

22.6 EXTERNAL LIGHTING

22.6.1 General

This section relates to specifications for supply (wherever called for), installation, connection, testing and commissioning of street area lighting and flood lighting installation in the project area.

The job in general comprises of specifications explained for :

a. Supply, installation of street, bollards, area lighting poles , fixtures, bracket, inter connecting cable complete with foundation, underground cabling , control panel earthing etc.

b. The street lighting installation for the project shall be carried out by use of outdoor type, weather proof luminaires, to be mounted on tubular steel pole as specified.

c. Electric power supply at 415 volt, three phase, four wire, 50 Hz. to be tapped from the control lighting panel.

d. The electric power shall be distributed to the street lighting poles through electric cables and shall be distributed equally on three phase of the electric power supply system.

e. Individual control fuse in terminal box shall be provided on each poles. The terminal box shall be weather proof, having gasketed hinged door cover. With epoxy insulators for cabkle termination.

f. The street light poles shall be earthed individually with pipe type earth station using 8 SWG G.I wire.as per IS 3043.

g. Electric cable required for the street lighting installation shall be 1100 volt grade, PVC insulated and sheathed, armoured cable having stranded Al. conductor of rating as mentioned in the drawing / BOQ.

22.6.2 Standards

The following standards and rules shall be applicable:

IS 1913	General and safety requirements for light fitings.
IS 1944	Code of practice for lighting public thoroughfares.
IS 3528	Water proof electric lighting fittings.
IS 3553	Water tight electric lighting fittings.
IS 1239	M.S. tubular and other wrought steel pipe fittings.
IS 10322	Luminaire for street lighting. (Parts / Sec. 3)

Indian Electricity Act and rules.

All codes and standards mean the latest. Where not specified otherwise the installation shall generally follow the Indian Standard Code of Practice or the British Standard Code of Practice in the absence of Indian Standard.

22.6.3 Lighting Poles

The street light poles shall be fabricated from heavy duty cold-rolled steel tubes conforming to IS: 1239 and hot dip galvanized or painted as specified.

The street light pole shall be fabricated as per the details and dimensions given.

The street light poles shall have base plate, a large excess panel, and approved disgned fixture mounting bracket at top.

The access panel shall provide easy access to a multiday connector and MCB, to be mounted inside the pole. The access shall be specially fabricated with adequate reinforcement and weather protection gasket to prevent ingress of moisture and vandal proofed.

Poles shall have large diameter entries for incoming and outgoing cables and two earth studs.

The poles fabricated shall conform to the approved drawings and shall be as per IS 12713 (Part I & II) / 1980.

The pole shall house a multi-way ELMEX/ epoxy type terminal block and MCB. Poles shall be installed on pedestal RCC foundation, complete with coping wherever required or specified.

Twin dome with 2 Nos 100W GLS/LED lamp

22.6.4 Standards applicable:

I.S. 875 (part III) 1987	Code and practice for design for structures
BSEN10-025/!)IN17100	Grades of M.S plates Welding
B.S 5135/AWS	Welding
B.S.IS01461	Galvanising
TR. No.7 2000 of ILE UK	Specification for Mast and foundation

Manufacturer of the Mast must have conducted wind tunnel test on their Mast sample.

22.7 SOLAR STREET LIGHTING

22.7.1 Scope

Supplying & erecting Solar Street Light Fittings suitable for specified wattage of CFL, along with GI/MS Pipe Pole. The system should be designed to automatically switch ON at dusk, Operate throughout the night, and automatically switch OFF at the dawn, under average daily, solar radiation conditions of 5 kWh/m on a horizontal surface.

22.7.2 Material

22.7.2.1 PV Module(s)

- The PV module(s) shall contain crystalline silicon solar cells.
- The power output of the module(s) under STC should be a minimum of 74 W, either two modules of minimum 37W output each or one module of 74W output should be used.
- The Operating voltage corresponding to the power output mentioned above should be 16.4 V.
- The open circuit voltage of the PV modules under STC should be at least 21.0V.
- The terminal box on the module should have a provision of opening for replacing the cable, if required.

22.7.2.2 Inverter:

- The inverter should be of quasi sine wave or full sine wave type with frequency in the range of 20-35 KHz.
- The total electronic efficiency should be at least 80%.
- No blackening or reduction in the lumen output by more than 10% should be observed after 1000 ON/OFF cycles (two minutes ON followed by four minutes OFF is one cycle).

- The idle current consumption should not be more than 10 mA.
- Electronics should Operate at 12 V and should have temperature compensation for proper charging of the battery throughout the year.
- Necessary length of wires, cables, and fuses should be provided.
- The PV module will be used to sense the ambient light level for switching ON and OFF the lamp.

22.7.2.3 Electronic Protections:

- Adequate protection is to be incorporated under no load conditions e.g. when the lamp is removed and the system is switched ON.
- The system should have protection against battery overcharge and deep discharge conditions.
- Fuses should be provided to protect against battery overcharge and deep discharge conditions.
- A blocking diode should be provided as a part o'f the electronics to prevent reverse flow of current throughout the PV module(s), in case such diode is not provided with the solar module(s).
- Full protection against open circuit accidental short circuit and reverse polarity should be provided.

22.7.2.4 Mechanical Hardware:

- A metallic frame structure (with corrosion resistance paint) to be fixed on the pole to hold the SPV module(s). The frame structure should have provision to adjust its angle of inclination to the horizontal between 0 and 45 degrees so that the module(s) can be oriented at the specified tilt angle.
- The pole should be made of mild steel pipe with a height of 9 meters above the ground level, after grouting and final installation. The pole should have the provision to hold the weather proof lamp housing. It should be painted with a corrosion resistant paint.
- A vented acid proof and corrosion resistant painted metallic box for outdoor use should be provided for housing the battery.

22.7.3 Method of Construction:

The entire solar light with all accessories shall be installed at designated place, duly wired and giving necessary testing.

22.8 Advanced Maintenance Free Earthing System

22.8.1 X GEL

- Should be Supplied in 10kG buckets (5kG part A+ 5kG part B)
- 10litres water for (5kG part A+ 5kG part B), the compound becomes as thick but fluid substance that retains water & releases ions. These ions improve the conductivity of the soil thereby drastically reduces soil resistivity

22.8.2 Z EARTH

a) Should be Supplied in 20kG bags
b) Must have the following properties :-

- ✓ Must retain moisture
- ✓ Must ensure thermal & humidity stability
- ✓ Must Possess Good diffusion/dissipation properties
- ✓ Must be Non corrosive

22.8.3 EARTH ROD

It is made up of 200µm (20mm diameter) copper bonded steel earth rods of 3M length.

22.8.4 Inspection pit

The earth termination system should be equipped with a disconnecting clamp housed in concrete or PVC inspection pit.

22.9 Advanced Lightning Protection System

22.9.1 General

The lightning protection system shall be of the enhanced type which is designed to attract lightning to a preferred point and safely convey the lightning energy to ground with minimal risk of side flashing via a pre-determined route.
The complete lightning protection system will comprise of the following key components:
(a) Lightning Air Terminal
(b) Mounting support
(c) Dedicated down conductor
(d) Lightning Strike Recorder
(e) Dedicated earthing system

22.9.2 The Lightning Air Terminal

a) The lightning air terminal shall be an Early Streamer Emission terminal which will respond dynamically upon leader activity in the near area.

b) The lightning air terminal shall be configured as a spheroid which is comprised of separate electrically isolated panels surrounding an earthed central finial.

c) The insulation material used to electrically isolate the panels shall be comprised of a base polymer which provides high ozone and UV resistance with a dielectric strength of 24 – 38 KV/mm.

d) The central finial shall be elevated above the spheroid to a length of 90mm.

e) The upper section of the central finial shall be rated to withstand 200KA.

f) An air gap shall be provided between the individual electrically isolated panels (4 panels) and the finial tip of the central rod.

g) Arcing shall occur between the panel sections of the spheroid and the finial tip only upon the progression of a lightning leader.

h) The lightning air terminal shall have no moving parts and will have no dependence on external power supply or batteries.

i) The lightning air terminal shall be tested and certified in accordance with the French National Standard – NF C 17-102. & IEC 60-1:1989

22.9.3 Mounting Support of Lightning Air Terminal

The mounting pole used to support the lightning air terminal shall either be a circular insulating fibreglass tube or aluminium or S.S mast or powder coated mast at a minimum height of 2 metres above the area to be protected. The pole will have an outside diameter of 68mm.
The mounting pole and supports shall be securely fixed with brackets and guy wires where required.The down conductor shall pass through the centre of the pole for the entire length of the pole.

22.9.4 Down Conductor

a. Each lightning air terminal should be fixed with one down conductor. The down conductor should have a minimum size of 70mm² and can be a insulated round copper conductor. The down conductor should be fixed securely every half metre. The down conductor shall be routed as directly as possible to the ground avoiding electrical shafts and sharp bends (minimum bending radius of 0,5m). The down conductor shall be of single length, devoid of any joints for the entire vertical run of the conductor.

b. As an alternative the use of a high voltage shielded cable is acceptable. The high voltage shielded cable shall consist of a core filler, stranded copper conductor, insulation material, outer copper conductor with external conductive sheath.

c. The main copper conductor within the high voltage shielded cable shall have a minimum cross sectional area of 75mm².

d. The outer diameter of the high voltage shielded cable shall be less than 38mm.

e. The high voltage shielded cable shall have a maximum inductance of 25 nH/m.

f. The main copper conductor shall allow for direct connection to the lightning rod through the use of a compression lug.

g. The high voltage shielded cable shall be fixed to the structure through the use of conductive saddles every two metres for the length of the cable route.

h. The high voltage shielded cable shall be installed as per manufacturer's instructions and shall not be subject to bends of less than 0.6 metres radius.

22.9.5 Event Recording Device

i. All systems shall be installed complete with the lightning strike recorder.
ii. The lightning strike recorder shall contain a mechanical 6 digit display which will register all lightning discharges with a sensitivity of 1500A 8/20 µs peak current impulse.
iii. The lightning strike recorder shall be housed in a IP 65 rated enclosure and will Operate without reliance on batteries or an external power source.

iv. The lightning strike recorder shall be installed as per the manufacturer's instructions.

22.9.6 Grounding

a) The grounding system shall incorporate the following individual components or a combination of the following –
flat copper tape buried to a depth of not more than 800mm or by deep driven copper bonded steel core ground rods10' x 5/8".
b) All components of the grounding system shall be electrically connected to the central injection rod which is securely connected to the lower end of the high voltage shielded cable.
c) The grounding system shall be installed so that the final impedance reading does not exceed 10 Ohms unless otherwise stipulated by the lightning protection manufacturer or consulting engineer.
d) It is recommended that the grounding system is bonded to all structural reinforcing steel of the building, along with all connecting services.
e) The use of ground resistance improvement material shall be applied in order to reduce the resistivity levels of the grounding system and maintain a constant low resistivity. The grounding system shall be maintenance free.

22.10 Installation, Testing and Commissioning

22.10.1 Equipment erection details

Bolts of the terminal pad/terminal connectors should be tightened and the surfaces shall be cleaned properly after equipment interconnection.
Cutting of the pipes wherever required shall be such as to avoid flaring of the ends. Hence only a proper pipe cutting tool shall be used. Hack saw shall not be used.
Handling of equipment shall be done strictly as per manufacturer's/supplier's instructions/instruction manual.
Handling equipment, sling ropes etc. should be tested periodically before erection for strength.
The slings shall be of sufficient length to avoid any damage to insulator due to excessive swing, scratching by sling ropes etc.

22.11 Earthing

22.11.1 Specifications

The earthing shall be done in accordance with requirements given here. Measurement of soil resistivity and earth mat design calculations for switchyard area shall be submitted by contractor for review by client. The main earth mat shall be laid in the switchyard area in accordance with the approved design requirements.
Neutral points of systems of different voltages, metallic enclosures and frame works associated with all current carrying equipments and extraneous metal works associated with electric system shall be connected to a single earthing system unless stipulated otherwise.
Earthing and lightning protection system installation shall be in strict accordance with the latest editions of Indian Electricity Rules, relevant Indian Standards and Codes of practice and Regulations existing in the locality where the system is installed.
a) Code of practice for Earthing IS: 3043
b) Code of practice for the protection of Building and an allied structure against lightning IS: 2309.

c) Indian Electricity Rules 1956 with latest amendments.
d) National Electricity Safety code IEEE publication.

22.11.2 Earthing Conductor Layout

Earthing conductors in outdoor areas shall be buried at least 900 mm below finished ground level unless stated otherwise.

Tap-connections from the earthing grid to the equipment/structure to be earthed shall be terminated on the earthing terminals of the equipment/structure as per "Earthing Details".

Earthing conductors or leads along their run on cable trench, ladder, walls etc. shall be supported by suitable welding/cleating at intervals of 750 mm. Wherever it passes through walls, floors etc., galvanised iron sleeves shall be provided for the passage of the conductor and both ends of the sleeve shall be sealed to prevent the passage of water through the sleeves.

Earthing conductor around the building shall be buried in earth at a minimum distance of 1000 mm from the outer boundary of the building. In case high temperature is encountered at some location, the earthing conductor shall be laid minimum 1500 mm away from such location.

Earthing conductors crossing the road shall be laid 300 mm below road or at greater depth to suit the site conditions.

Earthing conductors embedded in the concrete shall have approximately 50 mm concrete cover.

22.11.3 Equipment and Structure Earthing

Earthing pads shall be provided for the apparatus/equipment at accessible position. The connection between earthing pads and the earthing grid shall be made by two short earthing leads (one direct and another through the support structure) free from kinks and splices. In case earthing pads are not provided on the item to be earthed, same shall be provided in consultation with Owner.

Whether specifically shown in drawings or not, steel/RCC columns, metallic stairs etc. shall be connected to the nearby earthing grid conductor by two earthing leads. Electrical continuity shall be ensured by bonding different sections of hand-rails and metallic stairs.

Metallic pipes, conduits and cable tray sections for cable installation shall be bonded to ensure electrical continuity and connected to earthing conductors at regular interval. Apart from intermediate connections, beginning points shall also be connected to earthing system.

Metallic conduits shall not be used as earth continuity conductor.

Wherever earthing conductor crosses or runs along metallic structures such as gas, water, steam conduits, etc. and steel reinforcement in concrete it shall be bonded to the same.

22.11.4 Jointing

Earthing connections with equipment earthing pads shall be bolted type. Contact surfaces shall be free from scale, paint, enamel, grease, rust or dirt. Two bolts shall be provided for making each connection. Equipment bolted connections, after being checked and tested, shall be painted with anti corrosive paint/compound.

Connection between equipment earthing lead and main earthing conductors and between main earthing conductors shall be welded type. For rust protections, the welds should be treated with red lead and afterwards coated with two layers bitumen compound to prevent Corrosion.

Steel to copper connections shall be brazed type and shall be treated to prevent moisture ingression.

Resistance of the joint shall not be more than the resistance of the equivalent length of the conductor.

All ground connections shall be made by electric arc welding. All welded joints shall be allowed to cool down gradually to atmospheric temperature before put- ting any load on it. Artificial cooling shall not be allowed.
Bending of earthing rod shall be done preferably by gas heating.
All arc welding with large dia. conductors shall be done with low hydrogen content electrodes.
The 50x6mm GS flat shall be clamped with the equipment support structures at 1000mm interval.

22.11.5 Power Cable Earthing

Metallic sheaths and armour of all multi core power cables shall be earthed at both equipment and switchgear end. Sheath and armour of single core power cables shall be earthed at switchgear end only.

22.11.6 Earthing Conductors

Generall

All conductors buried in earth and concrete shall be of galvanised steel. All conductors above ground level and earthing leads shall be of galvanised steel, except for cable trench earthing.

Constructional Features of Galvanised Steel

a) Steel conductors above ground level shall be galvanised according to IS: 2629.
b) The minimum weight of the zinc coating shall be 610 gm/sq. m. and minimum thickness shall be 85 microns.
c) The galvanised surfaces shall consist of a continuous and uniformly thick coating of zinc, firmly adhering to the surfaces of steel. The finished surface shall be clean and smooth and shall be free from defects like discoloured patches, bare spots, unevenness of coating, spelter which is loosely attached to the steel globules, spiky deposits, blistered surfaces, flaking or peeling off etc. The presence of any of these defects noticed on visual or microscopic inspection shall render the material liable to rejection.

Tests

In accordance with stipulations of the specifications galvanised steel shall be subjected to four one minute dips in copper sulphate solution as per IS: 2633.
Procedure for Soil Resistivity Measurement
Soil resistivity measurement should be carried out with the earth tester. Please check the calibration report before performing the measurement. Also check
The measurement should be strictly followed as per procedure given in IS 3043 (Wenner method of measurement)

22.11.7 Some Guidelines

- The depth of burial of electrode 1/20th of electrode separation
- Electrodes to be in straight line & co-planar
- Minimum spacing 0.5 m to 1.0 m
- Preferred electrode spacing;
- 0.5, 1, 2, 4, 8, 16, 20, 32 (Small station) or
- 0.5, 1, 2, 5, 10, 20, 50 (Large station) etc
- Resistivity should be measured in all 8 directions
- For good contact stand electrode in tamped mud or pour a little water around it
- If resistivity reading is inconsistent repeat it by varying 's'

- Ensure current and potential circuits do not have excessive resistance due to poor connection or excessive resistance near electrodes
- Lay wires to electrodes to minimize mutual inductance
- Avoid recently filled area
- Resistivity measured for electrode spacing 'a' is a measure of resistivity up to depth 'a'
- Prepare graph of resistivity versus electrode spacing, which reflects variation of soil resistivity with respect to depth

22.12 LT panels, Distribution Boards, Control Panels

22.12.1 Erection

a) Electrical panels and bus duct shall be delivered in convenient shipping section. The contractor shall make his own arrangement for safe transportation of all the items to the erection site and also carry out complete loading/unloading during transportation. The contractor shall be responsible for final assembly and inter connection of bus bar / wiring. Foundation channel shall be grouted in the flooring by the contractor. Switchgear shall be aligned and leveled on their base channels and bolted or tack welded to them as per the instructions of the Engineer-in-charge. The earth bus shall be made continuous throughout the length. Loosely supplied relays and instruments shall be mounted and connected on the Switchgear. The contacts of the draw-out circuit breakers shall be checked for proper alignment and interchangeability.

b) After erection the switch board shall be inspected for dust and vermin proof. Any hole which might allow dust or vermin etc. to enter the panel shall be plugged suitably at no extra cost.

c) If the instrument transformers are supplied separately they shall be erected as per the direction of the Engineer of the client-. The contractor shall fix the cable glands after drilling the bottom/ top plates of all switch boards with suitable holes at no extra cost.

d) Range of overload relays/timers etc. shall be checked with requirement of motor actually to be connected at site and shall be provided accordingly.

e) The bus duct shall be suitably supported between switchgear and transformer. The opening in the wall where the duct enters the switchgear room shall be sealed to avoid rain water entry. The foundation of the switchgear shall be raised suitably for minor adjustment to ensure proper alignment and connection of the bus duct at no extra cost. Expansion joints, flexible connection, etc. supplied by the manufacturer / contractor of the bus duct shall be properly connected.

22.12.2 TESTING:

Before electrical panel is energised, the insulation resistance of each bus shall be measured from phase to ground. Measurement shall be repeated with circuit breakers in Operating positions and contacts open.

Before switchgear is energised, the insulation resistance of all control circuits shall be measured from line to ground.

The following tests shall be performed on all circuit breakers during erection.

i. Contact alignment and wipe shall be checked and adjusted where necessary in accordance with the breaker manufacturer's instructions.
ii. Each circuit breaker shall be drawn out of its cubicles, closed manually and its insulation resistance measured from phase to phase and phase to ground.
iii. All adjustable direct acting trip devices shall be set using values given by the Engineer of the client- / manufacturer.
iv. Close and trip the circuit breaker from its local control switch push button or Operating handle. Switch gear control bus may be energized to permit test Operation of circuit breaker with AC closing with prior permission of the Engineer-in-charge.
v. Test tripping of the electrically Operated circuit breaker by Operating mechanical trip device.
vi. Test proper Operation of circuit breakers latch, check carriage limit switch if provided.
vii. Test proper Operation of lock-out device in the closing circuit. Wherever provided by simulating conditions which would cause a lock-out to occur.
viii. Trip beaker either manually or by applying current or voltage to each of its associated protective relays.
ix. Before switchgear is energised, the tests covered above shall be repeated with each breaker in its normal operating position.
x. Capacitor banks shall be tested as per IS: 13340 / IPP3 & IS: 13585 (Part – I) / IPP4. In addition, test for output and /or capacitance, Insulation resistance test and test for efficiency of discharge device shall be carried out.
xi. All electrical equipment alarms shall be tested for proper Operation by causing alarms to sound under simulated abnormal conditions.

22.12.3 Performance For LT Panels, DB and Control Panel Test.

i. Insulation resistance test (contacts open, Breaker racked in position).

- between each phase of bus : Mega ohm
- between each phase & earth : Mega ohm
- DC and AC control & auxiliary circuits. : Mega ohm
- between each phase of CT/PT and : Mega ohm

ii. Proper checks Between CT & PT circuit have to be done for the following:
- CT ratio.
- CT secondary resistance.
- CT polarity check.

iii. Check for contact alignment and wipe.
iv. Check / Test all releases / relays.
v. Check mechanical interlocks.
vi. Check electrical interlocks.

vii. Check switchgear / control panel wiring.
viii. Check breaker / contractor circuit for

- closing-local and remote (wherever applicable)
- Tripping-local and remote (wherever applicable)
- Opening time of breaker/ contractor
- Closing time of breaker/ contractor

This performance letter shall be jointly signed by the Engineer of the Contractor and the contractor

22.13 Cabling Along With Accessories

22.13.1 Trenching for Laying of Cables (Underground System):

As the cable trench work involves earth excavation in all types of soil, murum, hard rock and asphalted road surface, back filling and removal of excess earth from site; the work site shall be left as clean as possible.

Cables shall be so laid in trench in such away, that it shall not interfere with other underground structure. Like water pipes, sewage lines or other structures. The services which become exposed by excavation shall be properly supported and protected from injury until the filling has been rammed solidly in places under and around them. Any telephone or other cables coming in the way are to be properly shielded / diverted as directed by the engineer in charge

Cable shall be laid at minimum depth of 1200 mm. for H.T and LT cable from ground level. The width of trench shall be sufficient for laying of required no. of cables.

Sand bedding 75 mm. thick shall be made below and above the cables. Layer of precast RCC tiles shall be laid above sand bedding to cover cable completely. More than one cable can be laid in the same trench by providing adequate clearance between two cables. However, the relative location of cables in trench shall be maintained till termination. The surface of the ground after back filling the earth shall be made good so as to conform in all respects to the surrounded ground and to the entire satisfaction of the engineer in charge / consultant.

For all underground cables, route markers should be used:

a) Separate route markers should be used for LT, HT and telephone cables.

b) Cable markers should be installed at an interval not exceeding 30 mtr. Along the straight routes of cables at a distance of 0.5 mtr. Away from centre of cable with the arrow marked on the cable markers plate indicating the location of cable. Cable markers should also be used to identify change in direction of cable route and for location of every joint in underground cable.

    i. RCC hume pipe for crossing road in cable laying shall be provided by employer. No deduction shall be made for cable laying in hume pipe for not providing tiles , sand and excavation. RCC hump pipe at the ends shall be

sealed by bituminous compound after laying and testing of cables by electrical contractor without any extra charge.

ii. The trench shall be excavated using manual and mechanical methods as per field conditions. Most main roads are of asphalt surface and some of the roads with cement concrete surface.

iii. An air compressor with pneumatic drill or equivalent mechanical tool will be essential if the road crossings are to be speedily made. Special system of laying hume pipe under road without digging the surface may be adopted if feasible.

iv. Where paved footpaths are encountered, the pavement slabs shall be properly stored and reinstated. Identification markers of other services shall be properly stored and restored.

v. The sides of the excavated trenches shall, wherever required, be well shored up with timber and sheeting.

vi. Suitable wooden/ sheet steel barriers should be erected between the cable trench and pedestrian/ motorway to prevent accidents. The barrier could be made out of sheet steel or wood planks. These could be portable types of size 1.5 m long by 1.2 m (height). These should be painted with red and white coloured cross stripes. Warning and caution boards should be conspicuously displayed. Red lights as warning signal should be placed along the trench during the nights.

vii. The excavated material shall be properly stored to avoid obstruction to public and traffic movement.

viii. The bottom of the excavated trench should be leveled flat and free from any object, which would damage the cables. Any gradient encountered shall be gradual.

22.13.2 Cable Tags and Markers

i. Each cable and conduit run shall be tagged with numbers that appear in the cable and conduit schedule.

ii. The tag shall be of aluminum with the number punched on it and securely attached to the cable conduit by not less than two turns of 20 SWG GI wire conforming to IS: 280. Cable tags shall be of rectangular shape for power cables and of circular shape for control cables.

iii. Location of cables laid directly underground or in PVC ducts shall be clearly indicated with cable marker made of galvanized iron plate/cast iron (applicable).

iv. Location of underground cable joints shall be indicated with cable marker with an additional inscription "Cable joints".

v. The marker shall project 150 mm above ground and shall be spaced at an interval of 30 meters and at every change in direction. They shall be located on both sides of road and drain crossings.

vi. Cable tags shall be provided on all cables at each end (just before entering the equipment enclosure), on both sides of a wall or floor crossing, on each duct/conduit entry and at each end & turning point in cable tray/trench runs. Cable tags shall be provided inside the switchgear, motor control centers, control and relay panels etc., wherever required for cable identification, where a number of cables enter together through a gland plate.

22.13.3 Cable Supports and Cable Tray Mounting Arrangements

i. The Contractor shall provide embedded steel inserts on concrete floors/walls to secure supports by welding to these inserts or available building steel structures.
ii. The supports shall be fabricated from standard structural steel members.
iii. Insert plates will be provided at an interval of 750 mm/ as required , wherever cables are to be supported without the use of cable trays, such as in trenches, while at all other places these will be at an interval of 2000 mm or as per site condition ..

22.13.4 Cable Termination and Connections

i. The termination and connection of cables shall be done strictly in accordance with cable and termination kit manufacturer's instructions.
ii. The work shall include all clamping, fittings, fixing, plumbing, soldering, drilling, cutting, taping, heat shrinking (wherever applicable), connecting to cable terminal, shorting and grounding as required to complete the job.
iii. Supply of all consumable, material, shall included in the scope of work and quoted offer by the Contractor.
iv. The equipment will be generally provided with un-drilled gland plates for cables/conduit entry. The Contractor shall be responsible for drilling of gland plates as required using proper tools, painting and touching up. Holes shall not be made by gas cutting.
v. Control cable cores entering control panel/switchgear/ MCCB/MCC/miscellaneous panels shall be neatly bunched, clamped and tied with nylon strap or PVC perforated strap to keep them in position.
vi. The Contractor shall tag/ferrule control cable cores at all terminations, as instructed by the engineer in charge. In panels where a large number of cables are to be terminated and cable identification may be difficult, each core ferrule may include the complete cable number as well.
vii. Spare cores shall be similarly tagged with cable numbers and coiled up.
viii. All cable entry points shall be sealed and made vermin and dust proof. Unused openings shall be effectively closed.
ix. Double compression type nickel plated (coating thickness not less than 10 microns) brass cable glands shall be part of the quoted work .All power and control cables shall be provided with dust and weather proof terminations.
x. The cable glands shall conform to IS: 6121. They shall comprise of heavy duty brass casting, machine finished and nickel plated, to avoid corrosion and oxidation. Rubber components used in cable glands shall be neoprene and of tested quality. Cable glands shall be of approved make.
xi. The cable glands shall also be suitable for dust proof and weather proof termination. The test procedure, for cable gland shall be as per manufacturer.
xii. If the cable-end box or terminal enclosure provided on the equipment is found unsuitable and requires modification, the same shall be carried out by the Contractor, as directed by the engineer in charge.
xiii. Crimping tool used shall be of approved design and make.
xiv. Cable lugs shall be tinned copper solder-less crimping type conforming to IS-8309 & 8394. Bimetallic lugs shall be used depending upon type of cables used.
xv. Solder-less crimping of terminals shall be done by using corrosion inhibitory compound. The cable lugs shall suit the type of terminals provided.

22.13.5 Storage and Handling of Cable Drums

Cable drums shall be unloaded, handled and stored in an approved manner .Rrolling of drums shall be avoided as far as possible. For short distances, the drums may be rolled provided they are rolled slowly and in proper direction as marked on the drum.

22.13.6 Directly Buried Cables/ Cables Laid in Ducts Underground

i. The Contractor shall construct the cable trenches required for directly buried cables. The scope of work shall include excavation in all type of soils, hard rock, murum and road, preparation of sand bedding, soil cover, supply and installation of pre cast concrete protective covers, PVC/RCC Pipes, back filling and ramming, supply and installation of route markers and joint markers and construction of chamber etc.. The Bidder shall ascertain the soil conditions prevailing at site, and include the costing in the quoting.

ii. The cable (power and control) between LT stations, control room, DG set/ building and fire lighting, pump house shall be laid in the cable trenches. In addition to the above, for lighting purpose also, buried cable trench can be used in outdoor area with cables laid in ducts, underground etc.

iii. Cable route and joint markers and RCC warning covers shall be provided wherever required. The voltage grade of cables shall be engraved on the marker.

iv. Cables wherever are to be placed in ducts shall be placed on cable jacks. They shall be guided through the ducts by means of the draw rope where possible. Threading shall be from one manhole or joint box or hand hole or chamber to the adjacent one, one span at a time. Cable shall not be allowed to rub excessively against the walls of the duct whilst being threaded in to avoid damage. The cable ends must be properly sealed. Any joints when necessary must be made at the manhole or joint box only and on no account will there be a joint outside these. Cables must have straight runs between manholes or chambers.

v. Tension as specified by the cable manufacturer for a particular type of cable shall only be put on a cable whilst pulling it into a duct.

22.13.7 Installation of Cables

i. Cabling in the control room shall be done on ladder type cable trays while cabling in switchyard area shall be done on angles in the trench and for Electrical to container terminal it will be done in PVC conduits laid underground.

ii. All cables from bay cable trench to equipments including and all internal, cables (both power and control) for all equipment, shall be laid in PVC pipes of required diameter as per IS: 4985 which shall be buried in the ground at a specified depth below finish formation level. Separate PVC pipes shall be laid for control and power cables.

iii. Cables shall be generally located adjoining the electrical equipment through the pipe insert embedded in the floor. In the case of equipments located away from cable trench either pipe inserts shall be embedded in the floor connecting the cable trench and the equipment or in case the distance is small, notch/opening on the wall shall be provided. In all these cases necessary to maintain the bending radius as recommended by the cable manufacturer.

iv. Cable racks and supports shall be painted after installation with two coats of metal primer (comprising of red oxide and zinc chromate in a synthetic medium) followed by two finishing coats of aluminum paint. The red oxide and zinc chromate shall conform to IS: 2074.

v. Suitable arrangement should be used between fixed pipe / cable trays and equipment terminal boxes, where vibration is anticipated.

vi. Power and control cables in the cable trench shall be laid in separate tiers. The order of laying of various cables shall be as follows, for cables other than directly buried.
   a. Power cables on bottom tiers.
   b. Control instrumentation and other service cables in top tiers.

vii. Power and control cables shall be securely fixed to the trays/supports with self locking type nylon ties with de-interlocking facility at every 5 meter interval for horizontal run. Vertical and inclined cable runs shall be secured with 25 mm wide and 2 mm thick aluminum strip clamps at every 2m.

viii. Cables shall not be bent more then the minimum permissible limit. The permissible limits are as follows:

- Cable and Minimum bending radius
- Power cable 12 D, above 60mm dia15 OD
- Control cable 10 D
- D is overall diameter of cable

ix. In each cable run some extra length shall be kept at a suitable point to enable one (for LT cables)/two (for H.T. cables) straight through joints to be made in case the cable develop fault at a later date.

x. Selection of cable drums for each run shall be so planned as to avoid using straight through joints. Cable splices will not be permitted except where called for, unavoidable or where permitted by the engineer in charge. If straight through joints are unavoidable, the Contractor shall use the straight through joints kit of reputed make. The cost of the same shall be deemed to have included in the respective cable item

xi. Control cable terminations inside equipment enclosures shall have sufficient lengths so that changing of termination in terminal blocks can be done without requiring any splicing.

xii. Metal screen and armour of the cable shall be bonded to the earthing system of the station, wherever required. Rollers shall be used at intervals of about two meters while pulling cables.

xiii. All due care shall be taken during unreeling, laying and termination of cable to avoid damage due to twist, kinks, sharp bends, etc.

xiv. Cable ends shall be kept sealed to prevent damage. In cable vault, fire resistant seal shall be provided underneath the panels.

xv. Inspection on receipt, unloading and handling of cables shall generally be in accordance with IS: 1255 and other Indian Standard Codes of practices.

xvi. Wherever cable pass through floor or through wall openings or other partitions, GI/PVC wall sleeves with bushes having a smooth curved internal surface so as not to damage the cable, shall be supplied, installed and properly sealed by the Contractor at no extra charges.

xvii. Contractor shall remove the RCC/Steel trench covers before taking up the work wherever provided and shall replay the covers after the erection-work in particular area is completed or when further work is not likely to be taken up for some time.

xviii. Contractor shall furnish three copies of the report on work carried out in a particular week, indicating cable numbers, date on which laid, actual length and route, testing carried out, terminations carried out, along with the marked up copy of the cable schedule and interconnection drawing wherever any modifications are made. Contractor shall paint the tray identification number on each run of trays at an interval of 10 m.

xix. In case the outer sheath of a cable is damaged during handling/installation, the Contractor shall repair it at his own cost to the satisfaction of the engineer in charge . In case any other part of a

cable is damaged, the same shall be replaced by a healthy cable at no extra cost to the Owner, i.e. the Contractor shall not be paid for installation and removal of the damaged cable.

xx. All cable terminations shall be appropriately tightened to ensure secure and reliable connections. The Contractor shall cover the exposed part of all cable lugs whether supplied by him or not with insulating tape, sleeve or paint.

xxi. The cable end seals shall be checked after laying and, if found damaged, shall immediately be resealed. Sufficient number of heat shrinkable cable end sealing caps shall be stocked at site stores for testing and jointing work. The integrity of the outer sheath shall be checked after the cable is laid in position.

22.13.8 RCC Hume Pipe

RCC hume pipe shall be of NP2 class with collar jointing, excavation in all types of soil, hard rock, murrum etc… up to a depth of 1 metre including back filling & sealing of ends to avoid choking of pipes.

The jointing of pipes shall be only through collar joints with cementing at end of the collars.

22.13.9 Cable Trays

i) The cable trays shall be of G.I .sheet and minimum thickness of sheet shall be 2mm. or as specified.

ii) The Contractor shall perform all tests and inspection to ensure that material and workmanship are according to the relevant standards. Contractor shall have to demonstrate all tests as per specification, and equipment shall comply with all requirements of the specification.

iii) Tests

- TEST FOR GALVANISING (ACCEPTANCE TEST)
- DEFLECTION TEST: (TYPE TEST)

A 2.5 meter straight section of 300mm, 600mm wide cable tray shall be simply supported at two ends. A uniform distributed load of 76 kg/m shall be applied along the length of the tray. The maximum deflection at the mid-span shall not exceed 7mm.

22.13.10 Proforma for Testing Cables:

i. Drum No. from which cable taken.
ii. Cable from ---- to -----
iii. Length of run of this cable --------metre
iv. Insulation resistance test
   - between core 1 to earth : Mega ohm
   - between core 2 to earth : Mega ohm
   - between core 3 to earth : Mega ohm
   - between core 1 to core 2 : Mega ohm
   - between core 2 to core 3 : Mega ohm
   - between core 1 to core 3 : Mega ohm

v. High voltage test
   - Between core an earth.
   - Between individual cores

This proforma shall be jointly signed by the Engineer-in-charge and the contractor in duplicate.

22.14 Installation of Lighting Fixtures

Scope of work under this item shall start from light point, with a connector/ ceiling Rose , 3core 1.5 mm.² PVC insulated wires from the point to the connector inside the lighting fixture, connections, fixing of lighting fixture complete with all accessories including supports, down rods , lamps on wall / roof / steel truss etc. testing the lighting fixture and commissioning.

22.14.1 Installation of Exhaust Fans

Scope of work under this system shall start from exhaust fan point, with a ceiling rose, 3core 2.5 mm.² PVC insulated wire from ceiling rose to connector of exhaust fan, connections, including fixing of fan with all accessories and supports complete with testing and commissioning.

22.14.2 Bracket for Street Light Fittings:

The brackets shall be made GI pipe with MS galvanised "sleeve" of required length and design, to accommodate type of street light fitting to be fixed.

22.14.3 Installation of Poles:

Installation of poles shall be done as approved by the Engineer /Employer.

22.14.4 Installation of Street Light Fixtures:

This specification includes fixing of street light fittings complete with accessories and lamps at the end of the pole / bracket, connecting it with 3 x 2.5 mm.² aluminium conductor, PVC insulated cable from terminal box, testing, commissioning. Third core shall be connected with earthing point of light fitting at one end and earthing point of terminal box at the other end.

22.15 Completion Tests

After supply and installation of complete project or a particular building / area, tests shall be carried out by the contractor before switching on the power to installation and the results shall be recorded and submitted to the Site-Engineer.

If results are not satisfactory / as per standards set herewith, the contractor shall identify the defects / shortcomings and shall rectify the same. Nothing extra shall be paid for carrying out these tests and contractor has to arrange all necessary instruments.

22.16 Protection

22.16.1 Insulation Resistance to Earth:

This is to be measured with all fuse links in place, all switches ON, all lamps and appliances in position by applying a voltage not less than twice the working voltage (subject to a limit of 500 V). Insulation resistance of the whole or any part of the installation to earth must not be less than 50 mega-ohms divided by the number of outlets (points and switch positions) except that it need not exceed one mega-ohm for the whole installation.

22.16.2 Insulation Resistance between Conductors

Tests to be made between all the conductors connected to one pole or phase conductor of the supply and all the conductors connected to the middle wire or neutral or the other pole or phase conductors of the supply. For this test, all lamps shall be removed and all switches put ON. The

result of the test must be 50 mega-ohms divided by the number of outlets (points and switch positions) but need not exceed 1 mega-ohm for the whole installation.

22.16.3 Polarity of Single Pole Switches

Tests shall be made to verify that all non-linked single pole modular switches are on phase conductor (live) and not on neutral or earth conductor. This can be done by connecting test lamps between two terminals of switch and earth. If the lamp lights up when switch is ON and either terminal is touched, the switch is correctly installed.

22.16.4 Safety Precautions while Testing

a. The following points to be taken care for safety purpose before testing: -
b. The work shall be carried out with the equipment dead or energised at a safe voltage or current.
c. The equipment shall not to be left unattended on live. There shall be no exposed live parts that are hazardous
d. The test personnel should be able to supervise the working area at all times to prevent danger to others.
e. The test personnel should be competent, posses authorised license i.e. adequately trained, experienced and knowledgeable to do the work safely and ensure that others are not put at risk.
f. The test personnel will be required to design and/or manufacture any special test equipment; they should know what standards or guidance should be followed and are these documents readily available.
g. Physical safeguards should be applied to the equipment under test to avoid danger and prevent injury e.g. the use of temporary or permanent screens or enclosures.
h. Routine maintenance shall be carried out on the hardware used in testing.
i. Check whether it is necessary to set up a permanent test area where equipment is taken or a temporary test area around the equipment and how will this be done.
j. Check the size of the unit under test and how much space is required around it to avoid congestion while testing.
k. Additional emergency switching, devices to be provided at easily accessible places.

22.17 Minimum Tool Box

LT Equipments

Sr. No	Item Description	Item Specification	Qty per Gang minimum	Remarks
TOOLS				
2	Crimping Tool	25-400sqmm	1 No	
	Cutting Pliers	8" insulated grip	1 No	
3	Screw Driver	9" power grip	1 No	
4	Screw Driver	4" power grip	1 No	
5	Adjustable Spanner	24mm	1 No	

Sr. No	Item Description	Item Specification	Qty per Gang minimum	Remarks
6	Spanner	24mm	1 No	
7	Hack Saw Frame and Blade	12"	1 No	
8	Knife	6"	1 No	
9	Bamboo/ FRP Ladder	3m local	1 No	
SAFETY GADGETS				
1	Helmets	Yellow without flap	Qty as per number of gang members	
		White normal	For Engineer/ supervisor	
2	Discharge Rods	20', 3 connectable fiber pipes	2 sets	
3	Caution Board	Red letters on white back ground on plastic base board (300x400mm)	2 sets	
4	Hand Gloves	15kV Rubber Grip	One pair	
5	First Aid Kit		1 No	
	For additional earthing	2 feet, local make	1 No	
TESTING & MEASURING EQUIPMENTS				
1	Tester	230V	1 No	
2	Measuring metal tape	3m	1 No	
3	Clip on meter	0-1000A	1 No	For engineers
4	CMRI	as per specifications	1 No	For engineers
5	Earth resistance tester		1 No	Optional Item

22.18 List of Preferred Makes of Equipments / Materials

Preferred makes of equipments and materials are given below. Although the preferred makes are given, the Contractor shall submit samples of all materials other than heavy equipments and obtain prior approval of the Engineer of the Contractor for the make of each item before ordering the same. This condition is also applicable to all items of equipments and materials for which makes are not given in this specification:

Sr. No.	Product	Make (ISI marked)
1.	DG Sets	• Sudhir Gensets • Kirloskar

		• Powerica Ltd. • Sterling & Wilson (P) Ltd.
2.	Power distribution panel / APFC Panel	• Abak Electrofab Engg. Pvt. Ltd. • Vivid Electromech Pvt Ltd • Zenith Engineers • Sterling & Wilson (P) Ltd • Arrow engineers • Antia electricals or any CPRI approved
3.	LV Glands & Lugs	• Dowell Electro Works • Jainsons • Asian • Comet • Cosmos • Hax Brass (Copper Alloy India)
4.	Current transformer	• Siemens • ABB • Crompton-Greaves • Automatic Electric Ltd, • Kappa • Indcoil • Ricco • Pelton Power
5.	Potential transformer	• Siemens • ABB • Crompton-Greaves • Automatic Electric Ltd, • Kappa • Indcoil • Ricco • Pelton Power
6.	Disrtibution Boards	• Legrand • Siemens • L&T • Schneider Electric
7.	LV Switchgear	• Legrand • Siemens • L&T • Schneider Electric
8.	LV Cables & Wires	• Primecab • Polycab • Finolex

		• Asian • KEI • RR Cables
9.	Busducts	• Legrand • L&T • Godrej • GE Power Control • C and S
10.	Automatic Transfer Switch (ATS)	• L&T (Auxe) • GE Power Control • HPL Socomac • Asco Emerson • Havells
11.	Power / Auxilary Contactor	• ABB • L&T • Siemens • Schneider Electric
12.	Static Power Meter & Logger (SPML) With RS 485 port	• Schneider Electric • L&T • HPL
13.	Digital Multifunction Meter (Load Manager)	• Schneider Electric • Siemens • L&T • IMP • Nippen • HPL • Electrex • Meco
14.	a. Electronic Digital Meter (A/V/PF/HZ/KWH) with LED display. b. Dual Energy Meter with centralized metering & billing system c. Prepaid Meters & accessories d. Electromagnetic Meters	• Schneider Electric • ABB • Secure • L&T • Automatic Electric • Conzerv
15.	Analog Voltmeter / Ammeter	• AE • L&T • IMP • Meco
16.	Voltmeter selector switch / Ammeter selector switch	• Siemens • L & T

		• Teknic • Kaycee • CG (Scame)
17.	Indicating Lamps (LED type) and Push Button	• Siemens • L & T • Teknic • Schneider Electric • GE Power Control
18.	Relay	• Siemens • L & T • ABB • Schneider electric
19.	Annunciator	• Areva • Minilec • Alan
20.	Terminal blocks	• Connectwell • Elmex • Technoplast
21.	DC battery	• Exide • Amar Raja • Emco
22.	Battery charger	• Universal • Chabbi electricals • Joshi electricals • Voltstat • JR electronics • Mastek
23.	Cable Tray and Race ways	• Profab • Rico Steel • Sadhana
24.	PVC Conduits & accessories	• Precision • BEC • AKG • Polypack
25.	Switches / Sockets / TV Socket / Telephone sockets / Data sockets / Regulators etc.(Modular)	• Anchor • Legrand • MK Honeywell • Wipro (North West) • Crabtree (Havells) • Philips
26.	Industrial Socket Metal Clad	• MDS Legrand

		• CG (Scame) • Schneider Electric (Clipsal) • C&S
27.	Industrial Socket Splash Proof	• MDS Legrand • CG (Scame) • Gewiss • Schneider Electric (Clipsal) • C&S
28.	Ceiling Fans/ Exhaust Fans	• Orient • Crompton • Bajaj • Usha • Anchor • Havells
29.	Lighting Fixture	• Bajaj • Philips • Wipro • GE
30.	Lighting poles	• Bajaj electricals • CG • Bombay tubes & poles • Gemeini Global • Keselec Schreder
31.	Lightning Protection System (Early streamer emission type)	• Indelec • Stormaster (Fast Track Enterprises) • ABB
32.	Maintenance Free Earthing	• Indelec • Stormaster (Fast Track Enterprises) • Ashlok
33.	Capacitor	• Epcos • Siemens • L & T • ABB • Schneider Electric • ABB
34.	Starters	• ABB • L & T • Siemens • Schneider Electric • Havells
35.	Power / Auxilary Contactor	• ABB

		• L&T • Siemens • Schneider Electric • Havells
36.	Timers	• ABB • L&T • Siemens • Schneider Electric • Havells

Note: If make of any item is not mentioned above or is missed out, the same shall be approved by the Engineer of the Contractor.

Electrical Items related to Car Parking System		
1	Aux. Relay/24V DC relay	Telemecanique/Idec/Omron
2	Power Cables	RR cabels/Finolex/Polycab/Lapp/Igus
3	Limit Switch	TEKNIC / BCH(USA)
4	MCB & MCCB	Siemens / L&T / ABB
5	Over Load Relay	Siemens / L&T / Telemecanique
6	Power Contractor	Siemens/L&T/BCH/ABB/Tecknic
7	MCCB/ Main incomer	Siemens / L&T / ABB/Tecknic
8	Star / Delta conversion timer	Siemens / L&T / Telemecanique
9	Terminals	Wago (Germany)/Connectwel/Phoenix(Germany)
10	Panel lights CFL	Philips/Wipro
11	Network Switch	Phoenix/Beckhoff
12	HMI	Beckhoff/Renu/Messung
13	Pushbuttons illuminated	Tecknic / Jai Balaji/Siemens
14	Emergency Push button	Tecknic / Jai Balaji/Siemens
15	Ethernet cable	Finolex / Polycab / Lapp
Electronics Items		
1	VFD for LIFT	Lenze/Yaskawa/Mitsubishi/SEW
2	Proximity Sensor	IFM/Baumer/Omron/Balluff
3	Main PLC & ACC	Beckhoff (Germany)
4	Micro PLC/Remote I/O	Beckhoff/Turck

SPECIFICATIONS FOR HVAC AND VENTILATION SYSTEM

1. JETVENT Centrifugal Induction / Impulse Fan

These Fans are to be used for providing Ventilation System. The JETVENT Centrifugal shall be as per European Standard EN12101-3:2002 and IS 3588:1987.

a. Quality Management: The unit is supplied with a fitted pad lockable external isolator switch protected to IP:65

Units shall be designed and manufactured with procedures as defined in BS EN ISO 9001:2000 and tested at elevated temperatures in accordance with the requirements of the European standard EN12101-3:2002.

b. A specially designed venturi inlet is provided to maximise the air input into the fan and motor assembly, whilst a fully adjustable air diffuser is provided to ensure maximum flexibility for air distribution and control.

c. A beveled section at the air supply side of the unit shall be provided to ensure that the air is directed away from transverse beam sections that may be present in the car park.

1.1 MIMIC Panel For JETVENT Fans

MIMIC Panel for JETVENT Fans with all required accessories shall be provided in the Control Room as per IS 3588:1987.

1.2 LT AC Supply

Voltage, Phase & frequency	:	380V-500V AC, 3 Phase, 50 Hz.
Voltage Variation	:	+ 10 %, – 10 %
Frequency Variation	:	48-62 Hz ± 1 %

The system should be solidly earthed with transformer neutral

1.3 Scope of Engineering Services & Documentation

The scope shall cover Design, Engineering, Manufacturing, Supply, and Commissioning of the AC Drive System for Basement Ventilation Fan Application for which the following documentation shall be provided.

1. Detail Electrical Circuit diagram
2. Instruction Manual giving details of Operation and Maintenance shall be provided.

1.4 Testing and Commissioning of System. (T and C)

The Car Park ventilation system will follow the general guidelines indicated below as far as testing and commissioning are concerned:

1. Provide a mega test on all wiring loops and record data.
2. Check incoming supply to all panel positions.
3. Check for continuity on all respective control loops.

1.4.1 Induction Fans.

1. Individually manually inspect each fan for rotation and clearance.
2. Run each fan individually on low and high speed.
3. Test each fan group for low and high speed Operation from the local control panel in each floor / zone.
4. Determine and record all relevant test data.

1.4.2 Main Supply Fans.

1. Individually manually inspect each fan for rotation and clearance.
2. Run each fan individually on low and high speed.
3. Test each fan group for low and high speed Operation from the local control panel in each floor / zone.
4. Determine and record all relevant test data.

1.4.3 Main Exhaust Fans.

1. Individually manually inspect each fan for rotation and clearance.
2. Run each fan individually on low and high speed.
3. Test each fan group for low and high speed Operation from the local control panel in each floor / zone.
4. Determine and record all relevant test data.

1.4.4 Full Scale Tests.

1. Run full coordinated test for Operation and activation of all low speed systems.
2. Run full coordinated test for Operation and activation of all high speed systems.
3. Check Operation of system transfer to high speed requirement from generall ventilation condition.
4. Run full coordinated smoke test for Operation and activation of all low speed systems and high speed system
5. Provide CFD analysis to consultant for approval.

1.5 System handover.

Training of GVSCCL/GVMC staff in the Operation and maintenance requirements for the entire system shall be done by the contractor.

2. Air conditioning Non Ductable Split Units:

2.1 Scope:

The scope of work comprises supply, erection, testing and commissioning of the air conditioning split units conforming to these specifications.

2.2 Evaporator unit:

2.2.1 Cooling Coil:

Cooling coil of the Evaporator shall be selected for face velocity not exceeding 500 fpm and shall be constructed from 3/8" O.D. copper tubing (22 G) with serrated and extended aluminum fins. Provide hydrophilic coated aluminum fins to minimize the angle of contact between water droplets and fins. Tubes shall be arranged in a staggered design for better efficiency. The tubes shall be expanded hydraulically to give tight bonding with the fins. Cooling coil circuits shall be fed liquid refrigerant through a capillary.

2.2.2 Blower:

The fan blower shall streamlined air fan. It shall be statically and dynamically balanced to give required airflow against desired static pressure and shall be driven by TEFC motor. The noise level of the fan should be in the range of 40 DB. Fan should be three-speed fan

2.2.3 Filters:

These shall be non-combustible fibrous cleanable filters to ensure clean air and easy replacement.

Provide anti fungus electrostatic air purification unit and de-odorizing activated carbon filter. The filter shall be capable to remove particles of size 0.1 microns. The filters should be slide in/slide out type.

2.2.4 Casing:

The casing shall be a bulkhead type structure having plastic moulded body. The top panel shall be double layered. The indoor unit shall have an insulated drain pan. The front casing shall be louvered for return air. A wide angled air flow grille shall be provided. The front grille should be detachable. The unit shall have an air director system incorporating a four-way rotation air outlet giving wide angled airflow. The unit should be fitted easily on wall.

2.3 Air cooled condensing unit:

The air-cooled condensing unit shall be complete with the following:

a. Compressor (hermetic)
b. Condenser coil
c. Condenser fan with motor.
d. Sheet steel casing with louvered bird screen etc.
e. Suitable GI base frame with mounting bracket for outdoor installation.
f. Anti-vibration mounts
g. Electrical isolating switch

2.3.1 Compressor:

The compressor shall be hermetically sealed compressor with internally built high and low pressure cut-outs and having low noise level with a refrigerant cooled motor. It should have time delay safety function. Provide jacket on compressor for noise reduction. The entire unit shall be mounted on anti-vibration mounts. Provision for incorporating refrigerant suction and discharge pressure gauges is required. There shall be one or two compressors per unit. The compressor shall Operate on R-22 refrigerant and shall have in-built thermistors for over current protection. The compressor should be reciprocating type. Rotary compressor is acceptable as optional.

2.3.2 Condenser coil:

Condenser coil shall be selected to give optimum performance. The coil shall be 3/8" O.D. copper tubing (22 G) with serrated and extended aluminium fins. Tubes shall be arranged in a staggered design for better efficiency. Condenser coil working pressure should be 300 psi. Condenser coils shall be designed to provide 30^0F sub-cooling and Operate at a saturated condensing temperature of 110^0F.

2.3.3 Condenser fan:

Axial flow fan for condenser shall be adequately sized and shall be direct driven. The fans shall be selected for low noise level and speed shall not exceed 920 rpm .Condenser fan motor to be IP55. The condenser fan motor shall have bimetallic relay for overload protection. Fan shall be provided with wire guard for safety.

2.3.4 Casing:

The unit casing shall be heavy gauge MS construction and painted with anticorrosive powder coated paint to give protection against rusting in high humid conditions. Painting shall be powder coating.

2.3.5 Protection

Condenser fan motor to be IP 55 (suitable for outdoor mounting) and all electrical components shall be housed in a water proof enclosure.

2.4 Remote control:

The unit shall have cordless remote except wherever specified in the bill of quantities. The Remote should have following functions.

1. Unit start/ Stop.
2. Temperature setting.
3. Operating mode
4. 24 hour on/off timer
5. Airflow swing activation.
6. Fan speed adjustment.
7. Memory restarts.
8. Sleep mode.

2.5 Electrical Characteristics:

The units shall be suitable for Operation on 230V ± 10%, 1 phase, 50 Cycles/415V ± 10%, 3 phase, 50 Cycles, 4 wire electrical supply.

The entire split AC unit complete with accessories shall comprise.

1. Evaporator unit with mounting brackets/supports.
2. Air-cooled condensing unit with outdoor support structure. The outdoor support structure shall be painted with 2 coats of epoxy primer and 2 coat Epoxy paint.
3. Electrical panel with starters etc., for compressor motor condenser fan motor, evaporator motor interlock local isolators for motors.
4. Corded Remote control
5. Operating thermostat and safety controls.
6. Installation accessories mounting brackets, refrigerant piping, filter Drier etc.
7. First charge of R – 22 refrigerant gas and oil.
8. Breaking holes, sleeves and making good.
9. Drain piping for evaporator unit.
10. Insulation of indoor unit, refrigerant piping and drain piping.
11. Electrical wiring from power supply provided by others.

12. Testing and commissioning.

2.6 Refrigerant piping:

Refrigerant piping shall be copper type L with brass fittings and suitable for flared connections piping shall be tested under vacuum of 7mm HG absolute for 24 hours prior to charging. Vacuum to be achieved using a vacuum pump use of compressor for vacuuming is not permitted.
Wherever refrigerant pipes are crossing the wall and wooden partition provide sleeves. Refrigerant pipes should be supported on grooved wooden strips suitable to accommodate the insulated refrigerant pipes. The piping should be clamped to these wooden strips using a 'C' clamps. The distance between two supports should not be more than 5 ft.
Wherever the pipes are running on the floor or exposed to view they should be covered with 18 G GI tray/plastic tray. The tray should be supported at every 8 ft. distance using clamp supports which are painted as approved by Consultant.

2.7 Electrical cables:

Electrical cable should be protected as described above. The cables running on the walls above false ceiling should be routed through enclosed PVC conduit.

2.8 Insulation:

Indoor units shall be insulated to prevent sweating. Drain pans to be insulated and sloped to drain. Indoor unit outlet collar shall be insulated with 13mm thick nitrile rubber insulation.

2.9 Drain piping:

Insulated Drain piping shall be hard PVC with necessary fittings and accessories minimum 25mm diameter for a single unit and 40mm diameter for 2 units' installation. Unit termination to be soft PVC. Drain piping should be insulated with 13 mm thick closed cell insulation. Insulation should be Armaflex / Kflex or equivalent.

3. Make list for HVAC and Ventilation Systems

The following make list must be followed for HVAC and Ventilation:-

Sr. No.	Equipment / Materials	Recommended Makes
1	Air handling Units	Carrier / Clivet / Edgetech / Nutech / Zeco
2	FAN COIL UNITS	Blue Star / Carrier Aircon / ETA / Sinko / Trane / Zeco
3	WINDOW / SPLIT UNITS/DUCTED SPLIT	BSL / Carrier / Daikin / Hitachi /Voltas
4	**VIBRATION ISOLATORS**	
a)	Springs, Neoprene Pads (Total rust resistant)	Kanwal Ind. Corp./ Polybond /Resistoflex
b)	Pipe flexible connections	Cori / Kanwal Ind. Corp. / Resistoflex
c)	Cushy Foot Mounts	Dunlop / Kanwal Ind. Corp / Polybond/ Resistoflex
d)	Floating Foundations	Kanwal Ind. Corp / Polybond /Resistoflex
e)	Insulated flexible ducts	Century, Diamond, Klimatech
f)	Flexible duct connector / Inst. Port	Klimatech
5	PRE-FILTERS & FILTERS (NON – FLAMMABLE)	Airtech / Thermodyne

Sr. No.	Equipment / Materials	Recommended Makes
6	ALUMINUM CLADDING – 24G	Hindalco / Indalco
a)	Ball valves	Audco / Zoloto / Giacomini
b)	Ball valves with Strainer	Audco / Zoloto / Giacomini
7	**VENTILATION & EXHAUST FANS**	
a)	Centrifugal	Comefri / Chaysol/ Greenheck / Kruger / Nadi / Nicotra / System Air
b)	Propeller	Alstom / Dyna Air / System Air
c)	Inline	Caryaire / Greenheck / Kruger / System Air
8	SHEET METAL	
a)	G I Sheets Class VII - 180 gm/sq.m	Sheets – Bhushen / Jindal /National /TISCO
b)	Fire dampers & extended sleeves	Caryaire / Cosmos / George Rao & Co. / Greenheck / TSC
c)	Fire Damper Actuators	Belimo – BF-T-24 / Siemens – GGA126.1E
9	**SUSPENSION / SUPPORT SYSTEMS (Fully galvanised for Ducts, Pipes, etc.)**	
a)	Anchor Fasteners	Hilte
b)	Fully threaded rods, nuts, bolts, pipe clamps etc.	Diamond, Hitech, Hilte, Perfect, Rolastar
c)	Channels / Angles – lengths with predrilled holes	Hitech, Hilte, Perfect, Rolastar
d)	Duct Flanges	Rolamate
10	**INSULATION**	
a)	Fibreglass Foil Faced (Thermal)	Kimmco / Owens Corning / UP - Twiga
b)	Fibreglass (Acoustic)	Kimmco / Owens Corning / UP –Twiga
c)	Black Glass Tissue	U P Twiga
d)	Phenotherm (underdeck)	Bakelite Hylam
e)	Phenolic foam pipe sections	Bakelite Hylam
f)	Expanded Polystyrene (TF)	Beardsell / Cooline / Modifoam
g)	Closed cell nitrile elostomeric Class 'O'	Armaflex / Eurobetex / K – Flex
11	**GRILLES / DIFFUSERS (POWDER COATED)**	
a)	Aluminium	Air-Product / Air Master /Cosmos
b)	Aluminium opposed blade dampers / louvres	Air-Product / Air Master /Cosmos
12	**ADHESIVES / VAPOUR SEALS**	
a)	Duct	Foster 81-10 / 81-22 / IIDL
13	CONDENSING UNITS	Blue Star, Carrier, ETA, Voltas
14	**ELECTRICALS – (IS)**	
a)	Starters	L&T / Merlin Gerlin / Siemens
b)	Contactors	ABB / L&T / Merlin Gerlin / Siemens
c)	Switchgear	Havells / L&T / Merlin Gerlin
d)	Ammeter	Auto-Electric, Rishab

Sr. No.	Equipment / Materials	Recommended Makes
e)	Voltmeter	Auto-Electric, Rishab
f)	All panel accessories	Technics
g)	Capacitors	Asian / Datar / L & T / Siemens
h)	ELCB's	Datar / L & T /MDS / Prok
i)	MCCBs, MCB's	ABB / L&T / Merlin Gerlin / MDS
j)	SFU's	ABB / L&T / Merlin Gerlin / Siemens
k)	Cables	Asian / CCI / Finolex / Gloster /Geoflex / Polycab

D: SPECIFICATION OF WORKS FOR CAR PARKING MANAGEMENT SYSTEM

1. In this semi automatic parking system, the customer first must pass through the bomb detection test whereby his car is kept on the said device for safety

2. Once cleared by this bomb detection unit, the user (on hourly / 24 hours basis) will use an Automatic Ticket Dispenser which will give him a bar coded ticket which will display the exact date and time at which he has entered the premise.

3. If he / she is a permanent user i.e. he / she is already allocated one slot in the car parking systems on lease for 1 month / 3 months / 6 months / a year, he /she would swipe his permanent access card in the system.

4. The customer would then move forward and park the car in one of the elevators of the Semi Automatic car parking system – as clearly indicated to him / her through various sign boards and display boards.

5. Collection of car parking fees in the waiting room must be provided through 1 collection counters to facilitate quick collection of car parking fees to avoid bottle neck at the exit points.

6. This collection counters must also have access to renew the lease period of permanent users who are using car spaces in this car parking tower on lease.

7. The user should just show the bar coded ticket / Permanent access card to the collection counter and once the same is scanned by the collection staff there, the system must immediately give a receipt for the number of hours the car was parked.

8. The payment must be collected against electronically generated receipts from the customers having bar coded tickets and zero value receipt generated electronically for Permanent access card holders shall be given.

9. The electronically generated receipt provided to the users shall be shown at the exit points for opening of the boom barriers.

10. In addition to the above, the collection booth at the exit counters will be utilized to make payment of car parking fees in case of redundancy of the mechanism in the waiting room.

11. A separate Ticket vending Machine and system for electronically generated receipt shall be provided at collection booths for scooters' entry and exit points.

12. The waiting room must have a seating capacity of at least 30 people.

13. Contractor's office and GVSCCL/GVMC office must have a display board of 0.75 m x 0.6 m which must contain the following information :-

    a. View of all CCTV Cameras

    b. Any mechanical failure in the car parking system

    c. Total Number of Car Spaces empty in the car parking tower

14. Control Room must have a display board of 1.0 m x 1.0 m which must contain the following information:

Number of car spaces empty / occupied at each level

    i. Any mechanical failure in the car parking system

    ii. Total Number of cars in queues for parking / retrieving

    iii. Serial number of tickets who want to retrieve their respective cars and the estimated time required to retrieve each of the cars.

    iv. List of Ticket Numbers whose estimated waiting time is less than 2 minutes and the elevator at which the customer possessing that ticket number can retrieve that car from.

15. All waiting rooms, must have a display board of 0.45 m x 0.3 m which must contain the following information:

    a) Total Number of cars in queue for retrieving

    b) Serial numbers of tickets who want to retrieve their respective cars and the estimated time required to retrieve each of the cars

    c) List of Ticket Numbers whose estimated waiting time is less than 2 minutes and the elevator at which the customer possessing that ticket number can retrieve that car from

16. Outside the entry / exit of the building, there must a display board of 0.45 m x 0.30 m on each of the locations containing the following information:

    a) Number of Car Spaces empty for Sedans

    b) Number of Car Spaces empty for SUVs

17. The automation system shall be suitable for acquiring data / information from various systems / sub-systems and process them to execute the functions as required for the Operations.

18. The level of automation shall satisfy the requirements of the promised specification for the car parking system like human interface, ticketing, tracking of the car, choice of least time critical path for parking, retrieval and metering etc.

19. A computer CPU with appropriate software will act through the PLC.

20. The software shall be based on the state-of-the art Operating system and shall be time tested for the type of parking installed.

21. The required UPS (Uninterrupted Power Supply) shall be provided.

22. Minimum Design Capacity to be provided by the Contractor under Various Control Devices working under the Car Parking Management System

Control Device	Design Capacity (Vehicles/Hour/Lane)	
	Entrance	Exit
Boom Barriers – Generall Security Check	250	250
Push-Button Ticket Dispenser	450	
Fixed Fee to Cashier	150	
Variable fee to Cashier		150
Coded-Card Reader	350	350

23. Specifications for Boom Barriers

Technical Specification	Description
Boom shape	Rectangular
Boom Length	Minimum 2.0 m
Minimum opening time (S)	3.5
Torque (Nm)	140
Work Cycle (%)	80
Protection Level	IP 54
Working TempGVSCCLture (°C min/ Max)	-20 °C to + 50 °C

24. Standards

The equipment and component parts shall conform to the relevant standards by Bureau of Indian Standards wherever available. They shall further conform to the latest Indian Electricity Rules. In addition they can conform to some of the standards or codes as follows:

a. ANSI: American National Standards Institution

b. CCITT: Consultative Committee for Telephone and Telegraph

c. EIA: Electronic Industries Association

d. EN: Euro Norm

e. IEC: International Electro-technical Commission

f. IEEE: Institute of Electrical & Electronic Engineers

g. ISO: International Organization for Standardization

h. NEC: National Electric Code

i. NEMA: National Electrical Manufacturer's Association

25. Make List

Given below is an indicative list of Makes of some of the components of Car Parking Management System:

Sr. No.	Items	Make
Electronics Items for Car Parking Management System		
1	VFD	Lenze/Yaskawa/Mitsubishi/SEW
2	Proximity Sensor	IFM/Baumer/Omron/Balluff
3	Main PLC & ACC	Beckhoff (Germany) / Turck
4	Micro PLC/Remote I/O	Beckhoff (Germany) / Turck
Computer Items		
1	Networking component	Phoenix/Beckhoff
2	Computer Systems	Apple/Dell/Lenovo/Samsung/LG

27. **Testing and Commissioning**

(i) During testing/commissioning, the Contractor shall supply all material and labour to supervise, adjust, test, repair and do all things necessary to maintain the testing/ commissioning of the car parking system.

(ii) The Contractor shall test and commission the system for 7 days at a stretch, from the date of commissioning. On expiry of this period the system shall be taken over by the Engineer- In- Charge and a taking-over certificate shall be issued by the Engineer in Charge, provided all defects and/or deficiencies noticed are rectified to the satisfaction of the Engineer- In- Charge.

(iii) The Contractor shall allow for commissioning to be conducted at any time during the commissioning period without extra charges under the Contract.

(iv) The main indicators for the successful commissioning are:

- Systems working satisfactorily in auto mode and manual mode
- execution of the entire work including finishing according to the drawings and the specifications
- submission of as built drawings

28. **Specifications of Cladding for Puzzle Parking Systems:-**

The 3 side Cladding on ground floor and 4 side Cladding for balance parking levels of Puzzle Parking Systems for all 9 modules including providing roofing at the top as per specifications given in the bid document and 2 Wheeler Parking with a roof incorporated at the top.

The exposed columns in the entire office block area – if any, shall be provided with cladding of 2 mm thick ACP sheets of approved shade fixed over the steel frame capable of tacking the impact of vehicle.

The cladding shall be of ACP (Aluminium composite panel) Cladding of 3 mm thick Aluminium composite panel (0.25 mm coil thick) - cladding made of Aluminium channel (25x50x1.6 mm) with cleat angle (8x18x2mm) - necessary hardware with backup material and weather sealant to make joint leak proof and supply and fixing of 3 mm thick pvdf coating aluminium composite panel complete in all respect of Indo bond or equivalent make as per approval of Engineer In-charge.

Spacing of the channel along the length should be approximate 2 feet or as per direction of Engineer In-charge. Some more details will be also given to you at the very earliest.

E: SPECIFICATIONS FOR OPERATION AND MAINTENANCE

1. Maintenance

Three types of Maintenance to be carried out by the Contractor

1. Preventive maintenance, where equipment is maintained before break down occurs. The contractor should make every effort to maintain the equipment before break down occurs. For this purpose the Contractor should ensure the Operation of all the stand by equipment in rotation.

2. Operational maintenance, where equipment is maintained while being used.

3. Corrective maintenance, where equipment is maintained after break down. This maintenance will of course be an integral part of the contract and in case of break down, the contractor must see to it that the said component is Operational within maximum 6 hours from the time of its occurrence.

The Contractor must take care of Maintenance, Repair, and Operations / Overhaul - (MRO) as explained below:

a) MRO involves fixing any sort of mechanical, plumbing or electrical device should it become out of order or broken (known as repair, unscheduled, or casualty maintenance).
b) It also includes performing routine actions which keep the device in working order (known as scheduled maintenance) or prevents trouble from arising (preventive maintenance).
c) MRO may be defined as, "All actions which have the objective of retaining or restoring an item in or to a state in which it can perform its required function. The actions include the combination of all technical and corresponding administrative, managerial, and supervision actions."

2. Operation

a) In case, the motor or any other equipment is burnt or damaged due to negligence of the contractor or due to faulty Operation it shall be sole responsibility of the Contractor to rewind/replace/repair it as per standards of the equipment free of cost within 72 hours.

b) In case of any fault in Operation and performance of the Facility, contractor or his staff at duty will immediately report to the GVSCCL/GVMC about it.

c) The Contractor shall run the entire car parking systems after ensuring proper voltage. He shall also record all the power failures and voltage in daily log sheet. He will bring into notice of power supply agency as well as control room and Departmental Engineer about the break down/power failure. He will also get the electricity restored simultaneously and will use DG sets immediately to reduce parking / retrieval time.

3. Specifications for Operation and Maintenance Manual

a. The contractor shall provide three copies of revised O&M Manual, if any, to the Engineer / Employer / GVSCCL/GVMC in soft as well as hard copies, at the time of the commissioning of the project.
b. The O&M Manual shall include in elaborate detail, all Operating and maintenance procedures and policies which are required, advisable and / or necessary for the Facility to achieve full compliance with the Operational guarantees and to achieve maintenance and repair standard for the Facility which will ensure compliance with the maintenance specifications.
c. Without limiting the generallity of the foregoing the O&M Manual shall include descriptions, procedures, and shall comply with the requirements, set forth in the provisions of the Bid Documents.
d. The draft of the O&M Manual shall be subject to the review and approval of employer, which shall have the right to make any changes and revisions to the O&M Manual as it may deem appropriate. The Contractor shall revise such draft O&M Manual prior to the commencement of the O&M period.
e. The contractor shall annually fully review, revise, update and modify the draft O&M Manual as may be necessary or appropriate.
f. During the term of this Agreement, the contractor shall promptly notify employer of any revisions, additions or modifications which he, in his professional opinion, believes should be made to the O&M Manual, whether as a result of additional experience in Operating and maintaining the Facility, changes or modifications to any equipment, part, component or structure incorporated in the Facility.
g. The Maintenance and Operation Manual shall have a write up on the procedure to be followed in case of fire.
h. There has to be a description of the system used for fire fighting and schedule of maintenance and refilling if any.
i. The location of the detectors and nozzles for distribution / spraying of the fire-fighting media shall be depicted on a proper drawing.
j. The Operation portion of the Manual will at least contain the following information:
    - Block diagrams for the safety interlocks
    - Block diagrams for the software
    - Clear description for the Macros
k. The Maintenance portion of the Manual will contain at least the following information:
    - Schedule of lubrication with type of lubricants to be used
    - Schedule of topping and oil changes for the gear boxes with type of oil
    - Schedule of bearings replacements
    - Schedule of replacement of the electrical contacts.
    - Generall Arrangement drawing
    - Drawing showing point of Lubrication for grease and oil for centralized lubrication
    - Manufacturing drawing with material for the maintenance items

- Block diagram for the electrical circuit
- Circuit diagram for the electrical circuit with identification of control gears and wire end ferrule numbering
- Block diagram for the PLC with identification.

4. Training

The Contractor shall plan and develop the course content, and implement on-the-job and classroom based training, for GVSCCL/GVMC deputed staff of at least 15 personnel in 3 batches of 5 personnel each, during first 6 months of the Operation & Maintenance period. The Contractor shall organize training for identified managers from amongst the GVSCCL/GVMC deputed staff in technical aspects of semi automatic car parking systems to enable GVSCCL/GVMC to build sufficient capacity and skills to manage the said car parking systems at a later date if required.

This training would include training in overhauling and replacement of various components of Semi Automatic Car Parking Systems, Electrical Systems, Plumbing, HVAC, Fire Prevention Systems, Fire Fighting Systems, Rain Water Harvesting Systems and expertise in Maintenance of the entire Office block.

The contractor shall provide on job training to the staff of GVSCCL/GVMC so that after completion of O&M period, GVSCCL/GVMC employees can easily maintain and Operate the systems on their own.

7.3 Drawings

The drawings provided, hereunder, are indicative only. However, since this is a design-built-Operate contract, the contractor has to develop his own drawings and submit the same for approval before execution.

LIST OF DRAWINGS

Sl. No.	Description	Drawing Number	No. of Sheets
1.	Site plan and section for proposed Mechanized Semi-Automatic Car Parking Facility near Jagadamaba Junction	VSC-GA-DWG-MLCP-01	One

Section VIII: General Conditions

These Conditions of Contract comprise two Parts: – General Conditions, and Special Conditions of Contract.

The Conditions of Contract, Volume I: General Conditions, shall be those forming Part I of "FIDIC – Conditions of Contract for Design, Build and Operate Projects, FIDIC Gold Book (2008)".

Copies of the FIDIC Conditions of Contract can be obtained from:

Federation Internationale des Ingenieurs–Conseils (FIDIC)
World Trade Centre II
P O Box 311
1215 GENEVA 15 (Switzerland)
Facsimile: 41 22 799 4901
Telephone: 41 22 799 4900

In cases of any differences, the provisions contained in Special Conditions of Contract shall take precedence over the provisions of General Conditions.

Section IX – Particular Conditions of Contract

CONTRACT DATA shall be read as Appendix to Tender

CLAUSE 1 GENERAL PROVISIONS

Sub Clause 1.1 Definitions

Amend Subparagraph 1.1.1.10 of Sub-Clause 1.1. to read as follows:

1.1.10(a) "**Contract**" means these Conditions of Contract (Parts I and II), the Employer's Requirements, the Tender, the Contractor's Proposal, the Schedules, the Letter of Acceptance, the Contract Agreement (if completed) and such further documents as may be expressly incorporated in the Letter of Acceptance or Contract Agreement (if completed).

For the purposes of defining the different activities and obligations under the Contract, the Contract will be comprised of a "**Works Contract**" and an "**O&M Contract**", as defined in the following Sub-paragraphs 1.1.10(b) and (c), respectively; such definitions are for convenience only and shall not affect the rights or obligations of the Employer or the Contractor under the Contract.

1.1.1.10(b) "**Works Contract**" means that portion of the Contract that relates to the **design, submittals, procurement, construction, fabrication, installation, testing, trial run, and commissioning of the Works or components of the Works, and the remedying of any defects including defect liability period** Operation and Maintenance, in accordance with the provisions of the Contract.

1.1.1.10(c) "**O & M Contract**" means that portion of the Contract that relates to the **Operation and Maintenance of the Works for the Operation and Maintenance Period**, as defined in the Appendix to Tender, but excluding the Works Contract, in accordance with the provisions of the Contract.

Amend Subparagraph 1.1.11 of Sub-Clause 1.1. to read as follows:

Substitute the words 'if any' *by words* 'if completed' *within the brackets*.

Amend Subparagraph 1.1.75 of Sub-Clause 1.1 by adding the following words at the end:

"The word '**Tende**r' is synonymous with '**Bid**', and their derivatives, bidder/tenderer, bid/tender, bidding/ tendering" as well as the words "Tender Documents" and "Bid Documents" are also synonymous."

Delete Subparagraph -Clause 1.1.78 and replace it with the following:

1.1.78 (i) "**Time for Completion of Works**" means the time period, starting from he Commencement Date, within which Contractor is required by Contract to complete the Works. The numerical value for Time for Completion of Works is specified in Appendix to Tender.

(ii) "**Operation and Maintenance Period**" means the time period during which the Contractor shall be fully responsible for operation and maintenance of the Works, starting from the date of completion of the Works as certified by the Employer's Representative]. The numerical value for Operation and Maintenance Period is specified in Appendix to Tender.

Amend Sub paragraph 1.1.13to read as follows:

1.1.13 "**Final Contract Completion Certificate**" means the certificate issued by the Employer's Representative upon satisfactory completion of the Operation and Maintenance responsibilities under Sub-Clause 8.6[*Contract Completion Certificate*].

Delete Sub paragraph 1.1.16 and replace it with the following:

1.1.16(a) "**Contract Price**" means the price as defined in Sub Clause 14.1[*The Contract Price*], and includes the adjustments in accordance with the Contract.

For the purposes of determining payments under the Contract and, where applicable, other obligations, the Contract Price shall be subdivided into a "**Works Contract Price**" and "**O&M Contract Price**", as defined in the following Sub paragraphs 1.1.16(b) and (c), respectively.

The total "**Contract Price**" will be the sum of the Works Contract Price and the O&M Contract Price.

1.1.16(b) "**Works Contract Price**" means that portion of the Contract Price payable to the Contractor for performance of the Works Contract in accordance with the provisions of the Contract. The **Works Contract Price** will be the total of the amounts for carrying out the Works, as set out in Volume III Schedule of Prices, under for Various Packages

1.1.16(c) "**O&M Contract Price**" means that portion of the Contract Price payable to the Contractor for performance of the O&M Contract in accordance with the provisions of the Contract. The **O&M Contract Price** will be the total amount for operation and maintenance during the O&M period, as set out in Volume III , Schedule of Prices, under Schedule for Operation and Maintenance.

Amend Sub paragraph 1.1.61 to read as follows:

1.1.61 "**Permanent Works**" means all Civil, Mechanical, Electrical, Instrumentation and Control, and any and all allied components necessary for fully functional and operational installations and facilities capable of meeting all performance and other requirements specified in Volume II of Bid Documents,.

Add the Sub paragraph 1.1.84 as follows:

1.1.84 "**Facilities**" means the Works executed and completed by the Contractor after trial run and commissioning, and remedying defects therein in terms of the Contract.

Add Sub paragraph 1.1.85 as follows:

1.1.85 "**Operations and Maintenance**" means performance of any and all tasks and provision of any and all things necessary for the safe and efficient functioning of the

Works in compliance with all applicable regulations and the O&M Contract. This includes but is not limited to supply of all labour, equipment, materials, fuel and other consumables, and all other necessary things.

Sub-Clause 1.5 Priority of Documents

Replace the list of documents listed under (a) to (h) with the following:

1. the Contract Agreement (including addenda, clarification, when signed by all parties concerned)
2. the Letter of Acceptance
3. Volume I Special Conditions of Contract
4. Volume I : General Conditions of Contract
5. Volume II Works Requirement / Technical Specification
6. Volume III: The Bid (accepted Price Proposal)
7. Volume IV: Bid Drawings
8. Completed Technical Schedules
9. Bidder's Technical Proposal other than Completed Technical Schedules
10. Any other documents issued by the Employer before signing the Contract Agreement and forming the part of the Contract

Sub-Clause 1.6 Contract Agreements

Replace the entire text of Sub clause 1.6 with the following:

"A Contract Agreement in the form annexed, with such modifications as may be necessary to record the agreement reached, shall be executed within the time period. The costs of stamp duties and similar charges imposed by the law shall be borne by the Contractor."

"Not signing the Contract Agreement for any reason whatsoever shall not affect the contract entered into by the Contractor and the Employer by the Letter of Tender and the Letter of Acceptance issued by them respectively".

The Time period for signing the Contract agreement will be as per clause 49 of Section 1

(ITB) Instruction to Bidders – Volume 1

Sub-Clause 1.8 Assignments

Add the following text at the end of Sub-Clause 1.8:

"Any assignment in terms of Sub-paragraph (b) above shall be subject to the condition that the bank or financial institution will not have any rights under or in relation to the Contract, except to direct that all or any payments that are offered to be made by the Party liable to make such payments be made to the person or to the account designated by the bank or financial institution."

Sub-Clause 1.9 Care and Supply of Documents

Replace the text of third paragraph with the following:

If a Party becomes aware of an error or defect in a document which was prepared for use in performing work under the Contract, the Party shall promptly give notice to the other Party of such error or defect

.Add the following text at the end of Sub-Clause 1.9:

"Failure to issue such notice by the Employer or the Employer's Representative to the Contractor in respect of any error in the Contractor's Documents shall not in any manner relieve the Contractor of its obligation to ensure the correctness and accuracy of the Contractor's Documents, and their compliance with the requirements of the Contract."

CLAUSE 2 THE EMPLOYER

Sub-Clause 2.1 Right of Access to the Site

Replace the first, second, and third paragraph of this sub clause with the following:

The Employer shall give the Contractor right of access to, and licensee possession of, all parts of the Site starting from the "Date of Access to Site" stated in the Appendix to Tender. The right and possession may not be exclusive to the Contractor. If, under the Contract, the Employer is required to give (to the Contractor) licensee possession of any foundation, structure, plant, or means of access, the Employer shall do so at the time and in the manner stated in the Bid Documents. If no such information is provided in the Bid Documents, the Employer shall give the Contractor right of access to, and licensee possession of, the Site at such times as necessary in accordance with the programme submitted under Sub-Clause 8.3 [*Programme*]. However, the Employer may withhold any such right or licensee possession until the Performance Security has been received.

If the Contractor suffers delays as a result of a failure by the Employer to give any such right or licensee possession in accordance with the Contract, the Contractor shall give notice to the Employer's Representative and, subject to Sub-Clause 20.1[*Contractor's Claims*], shall be entitled to

(a) An extension of time for any such delay, if completion is or will be delayed, under sub-clause 9.3 (extension of Time for completion of Design Build: and

(b) Contractor will not be entitled for any additional payment and other costs due to such delays.

There will be no claim for such financial implications to the Contractor

CLAUSE 3 THE EMPLOYER'S REPRESENTATIVE

Sub-Clause 3.1 Employer's representative Duties and Authority

*Delete the last sentence of third paragraph of this Sub-Clause 3.1 "*The Employer undertakes……. ...except as agreed with the Contractor."

Replace the entire text of fourth paragraph with the following:

Whenever the Employer's representative exercises a specified authority for which the Employer's approval is required, then such exercise of authority shall be valid for the purposes of this Contract only if it is accompanied by approval from the Employer.

Add the following text at the end of Sub-Clause 3.1:

"The Employer's representative shall obtain specific written approval of the Employer before taking any of the following actions under the respective clauses of the Contract:

(a) determining value, cost, or extension of time under Sub-clause 3.5 [*Determinations*],

(b) approving Sub-contracting of any part of the Works under Sub-Clause 4.5.[*Nominated Subcontractors*],

(c) granting an extension of the time for completion under Sub-Clause 9.3 [*Extension of Time for Completion*],

(d) suspending progress of part or all of the Works under Sub-Clause9.7 [*Suspension of Works*]

(g) issuing a **Final Contract Completion Certificate** for Completion of the Operations and Maintenance Services under Sub-Clause 8.6 [*Completion of the Operations and Maintenance Services*],

(h) issuing a variation under Clause 13 [*Variations and Adjustments*],

(i) determining the validity of any claims made by the Contractor under Sub-Clause 20.1 [*Contractor's Claims*].

Notwithstanding the obligation to obtain Employer's approval as set out in the preceding paragraph, if, in the sole opinion of the Employer's Representative, an emergency occurs affecting life-safety or the safety of the Works or of adjoining property, the Employer's Representative may, without relieving the Contractor of any of its duties and responsibilities under the Contract, instruct the Contractor to execute all such work or to do all such things as may, in the sole opinion of the Employer's Representative, be necessary to address the emergency. The Contractor shall forthwith comply with the instructions of the Employer's Representative despite the absence of approval of the Employer. The Employer's Representative shall determine whether the emergency situation was caused by the Contractor's actions or lack thereof or whether it was beyond the Contractor's control and make a recommendation to the Employer regarding extra costs payable to the Contractor, if any, for addressing the emergency situation. The Employer will make the final determination regarding whether or not any additional payments will be made to the Contractor."

Notwithstanding anything stated in this Contract, the Employer's Representative being treated as an Employee, agent or representative of the Employer for the purposes of this Contract, shall not be construed in any manner whatsoever for the purpose of attributing to the Employer any act, omission, determination, certification, or evaluation of the Employer's Representative under or in relation to this Contract and the Employer shall be entitled to dispute any or all such acts, omissions, determinations, certifications, or evaluations made by the Employer's Representative as provided under this Contract, either before the DAB or by arbitration.

Sub-Clause 3.3 Instructions of the Employer's representative

Delete the entire text of Sub-Clause 3.3 and replace it with the following:

The Employer's Representative may at any time issue written instructions to the Contractor to perform tasks that may be necessary for proper execution of the Works and/or the remedying of any defects, all in accordance with the Contract. The Contractor shall promptly comply with such

instructions. Failure to so comply may result in delays in the payments associated with the work components in question.

Sub-Clause 3.4 Replacement of Employer's representative

Add the following text at the end of Sub-Clause 3.4:

"The Employer's representative shall serve as an agent or a representative of the Employer. Mere change in the incumbent of the position of the Employer's Representative by reason of transfer, retirement or otherwise shall not be construed as replacement of the Employer's Representative for the purpose of this Contract."

Add Sub-clause 3.6 –Meetings, as below:

Sub-Clause 3.6 Meetings

"The Employer's Representative or the Contractor may require the other to attend meetings as necessary in order to discuss matters related to the Works or Operation and Maintenance. The party initiating the meeting shall provide a written agenda to the other party no less than three (3) working days prior to the date of the meeting, unless the meeting is required to address an emergency. The party initiating the meeting shall prepare meeting minutes documenting the proceedings of such meetings and supply copies of the minutes to those attending the meetings and to the Employer. The minutes shall assign responsibilities for any actions to be taken in accordance with the Contract."

Add the Following Sentence at the End of Clause 3

The word Engineer in Charge / Engineer / Project Manager / PMC is synonymous with Employer's Representative

CLAUSE 4 THE CONTRACTOR

Sub-Clause 4.1 Contractor's General Obligations

Add the following sentence to precede the existing text under Sub-Clause 4.1:

"The Contractor shall check the design criteria and calculations (if any) included in the Bid Documents and satisfy itself regarding their accuracy and adequacy. Contractor shall meet the minimum design and sizing requirements specified in the Bid Documents – a design that does not meet such minimum requirements shall not be acceptable and will result in rejection. Further, if Contractor believes that the minimum design and sizing requirements specified are not adequate to meet the minimum performance requirements specified, then Contractor shall make whatever upward adjustments to the design and sizing it deems necessary to meet the performance requirements and include these in the bid price. Contractor assumes full responsibility for meeting the specified performance requirements and ensuring the adequacy of the Works for this purpose."

In the second sentence of the fifth paragraph replace the words 'notified to' *by the words* 'approved by'.

Add the following sentence at the end of Sub-Clause 4.1:

"The Contractor shall attend all meetings as required by the Employer or the Employer's Representative."

Sub-Clause 4.2 Performance Security

Replace the entire text of Sub-Clause 4.2 with the following:

"The Contractor shall provide a Performance Security at his cost for its proper performance of the Contract, to be delivered to the Employer within 14 days after the receipt of the Letter of Acceptance. The Performance Security will be as specified in the Appendix to Tender, and shall be in the form of an unconditional and irrevocable bank guarantee issued either by a Nationalized or Scheduled Bank located in India or a foreign bank through a correspondent bank located in India and acceptable to the Employer.

The Performance Security shall be valid until the Contractor has fully and satisfactorily completed all of its obligations of the DB Contract. Half of the performance security shall be released after issuing of Commissioning Certificate; the remaining half of Performance Security will be released to contractor after completion of contract i.e completion of Operation & Maintenance period and shall be valid up to 30 days beyond expiry of the Operation and Maintenance Period."

The Performance Security for the Operation and Maintenance Period will be released to the Contractor within 14 days of the issue of the Final Contract Completion Certificate following completion of Operation and Maintenance of the facilities as per Sub-Clause 10.6.

Prior to making a claim under the Performance Security, the Employer shall, in every case, notify the Contractor stating the nature of the default for which the claim is to be made."

Sub-Clause 4.3 Contractor's Representative

At the end of Sub-Clause 4.3 add the following:

"If the Contractor's Representative is not fluent in the English language, the Contractor shall make a competent interpreter available during all working hours for the entire duration of the Contract."

Sub-Clause 4.4 Subcontractors

Replace the entire text of Sub-Clause 4.4 with the following:

"The Contractor shall not subcontract more than 25% (twenty-five percent) of the Works Contract Price, and any proposed subcontracts shall be subject to the following conditions:

(a) for all subcontracts, whether proposed in the tender or at a later date, the Contractor shall, in the format provided in Volume I, Section IV A Bidding Forms (Schedule VII - Sub-Contracting), submit a list of proposed Subcontractors along with their credentials including technical capability, financial capability, and experience in works similar to those which are proposed to be subcontracted;

(b) the Employer's Representative will scrutinize the proposals submitted by the Contractor and approval of the Subcontractors will be based on their overall capacity to execute the works proposed to be subcontracted;

(c) the prior approval of the Employer's Representative shall be obtained for all proposed Subcontractors, as well as for the proposed agreement(s) between the Contractor and such proposed Subcontractors;

(d) the Contractor shall submit a copy of the proposed agreement between the Contractor and the proposed Subcontractor, and such agreement shall require approval of the Employer's Representative.

The Contractor shall be responsible for ensuring that no unauthorized subcontractors are permitted to work on any part of the Site. If, at any stage during execution, a subcontractor is found working at the Site without prior approval of the Employer's Representative, then the work being done by that subcontractor shall be stopped, the subcontractor shall be expelled from the Site, and the Employer's Representative and Employer will jointly determine what components of the subcontractor's work are acceptable, what components shall be reworked or remedied by the Contractor, and what payment, if any, is payable for the subcontractor's work.

The act of subcontracting any part or component of the Works shall not relieve the Contractor of his overall responsibilities under the Contract. The Contractor shall be responsible for compliance by all Subcontractors with all the provisions of the Contract. The Contractor shall be responsible for the acts or defaults of any Subcontractor, his agents, or employees, as fully as if they were the acts or defaults of the Contractor, his agents, or employees.

In the event that the Employer's Representative determines that any Subcontractor's performance with respect to progress, quality, or Contract compliance is unsatisfactory, then the Contractor will be required to remove such Subcontractor from the Site and either undertake the Works itself or provide a suitably qualified replacement. If any delays occur as a result, the Contractor will be responsible for taking any necessary actions to make up the lost time, for which no additional payments or extension of time will be granted."

The Contractor shall carry out all Operation and Maintenance of the Works solely by himself and shall not sub-contract any part of the O&M Contract.

Sub-Clause 4.6 Co-operation

In the last paragraph replace the words 'possession of' *by the words* 'access to'.

At the end of Sub-Clause 4.6 add the following:

"The Contractor shall be responsible for the co-ordination and proper execution of the Works, including co-ordination with other contractors, sub-contractors, and organizations to the extent specified in the Employer's Requirements".

Sub-Clause 4.8 Safety Procedures

Replace the entire text of Sub-Clause 4.8 with the following:

Unless otherwise stated in the Employer's Requirements, the Contractor shall, from the date of the Employer providing right of access to or licensee possession of the Site to the Contractor under Sub Clause 2.1 [*Right of Access to the Site*], until completion of its obligations under the Contract (including the O&M Contract), shall:

(a) comply with all applicable health and safety regulations,

(b) ensure the health and safety of all persons present on the Site in an authorized capacity,

(c) use reasonable efforts to keep the Site and the Works clear of debris or unnecessary obstructions,

(d) provide lighting, and security for the Site and the Works

(e) provide any Temporary Works (including roadways, walkways, guardrails, and fences) that may be necessary for performance of the Contractor's work, for the use and protection of the public and of the Employers and occupiers of adjacent land.

"The Contractor shall submit, within 14 days of signing of the Contract Agreement, the required Safety Plan developed in accordance with the requirements set out in Volume II, for approval by the Employer's Representative. The Employer's Representative will either approve the submittal or provide comments thereon to the Contractor within 14 days of submission by the Contractor. The Employer's Representative's, approval, disapproval, comments, or failure to provide any of these to the Contractor, shall in no way relieve the Contractor of any of its obligations or responsibilities under the Contract."

Sub-Clause 4.9 Quality Assurance

Replace the entire text of Sub-Clause 4.9 with the following:

"The Contractor shall institute a Quality Assurance and Quality Control (QA/QC) system in accordance with the requirements set out in Volume II to demonstrate compliance with the requirements of the Contract.

The Contractor shall submit, within 14 days of signing of the Contract Agreement, the required Quality Assurance and Quality Control (QA/QC) Program for approval by the Employer's Representative. The Employer's Representative will either approve the submittal or provide comments thereon to the Contractor within 14 days of submission by the Contractor. The Employer's Representative's, approval, disapproval, comments, or failure to provide any of these to the Contractor, shall in no way relieve the Contractor of any of its obligations or responsibilities under the Contract."

The Contractor, prior to commencement of work at the Site, shall set up his own laboratory, with prior notification to the Employer's Representative. The calibration of the laboratory equipment and instruments shall be certified by agencies approved by the Employer's Representative. Laboratory equipment shall be properly maintained and calibrated throughout the period of the Contract by the Contractor at his own expense.

The Contractor shall give the Employer's Representative reasonable advance notice prior to conducting any tests required by the Bid Documents, which the Employer's Representative may choose to witness at his discretion. The Employer's Representative will also inspect the laboratory if deemed necessary and the Contractor shall provide adequate facilities to the Employer's Representative that may be necessary for witnessing testing or for independent verification of the accuracy and adequacy of the facilities and equipment. The list of mandatory equipment to be provided at the Site by the Contractor is indicated in Volume II.

Compliance with the QA/QC system shall not relieve the Contractor of any of his duties, obligations, or responsibilities under the Contract.

Sub-Clause 4.10 Site Data

Insert the following paragraph after first paragraph:

"The Employer does not warrant either the sufficiency or accuracy of site data provided in the Bid Documents or elsewhere. The Contractor shall be fully responsible for independently verifying or obtaining any and all site data that Contractor deems necessary to prepare the bid. Any Site data in

Employer's possession that is not included in the Bid Documents will be available for inspection at the Employer's address provided in the Appendix to Tender.

In the first sentence of the second paragraph, delete the following words:

"To the extent which was practicable (taking account of cost and time),"

In the Fourth sentence of the second paragraph delete the following words:

"To the same extent,"

Replace the text of Item (c) with the following:

"the extent and nature of the work and Goods necessary for execution and completion of the Works Contract and the O&M Contract."

Sub-Clause 4.11 Sufficiency of the Accepted Contract Amount

Add the following words at the end of the last sentence of this Sub-clause:

"…., and satisfactory completion of the O&M Contract."

Sub-Clause 4.12 Unforeseeable Physical Conditions

Replace Sub paragraph (b) of the Sub Clause with the following:

b) Except as otherwise stated in the Agreement or mutually agreed upon with GVSCCL

i. the Contractor accepts complete responsibility for having foreseen all difficulties and costs of successfully completing the Works;

ii. the Contract Price shall not be adjusted to take account of any unforeseen difficulties or costs; and

iii. the Scheduled Completion Date shall not be adjusted to take account of any unforeseen difficulties or costs

Sub-Clause 4.17 Contractor's Equipment

Replace the first sentence with the following:

"Unless otherwise stated in the Employer's Requirements, the Contractor shall provide all Contractor's Equipment necessary to fully and satisfactorily complete the Works Contract and the O&M of the facilities"

Add the following paragraph at the end of this Sub-clause:

"The Contractor shall submit, within 14 days of signing the Contract Agreement, the proposed Deployment Program for all necessary Equipment, Plant, and Machinery to be used for construction, for approval by the Employer's Representative. Such Deployment Program shall be developed using normally available commercial project management software and shall show equipment, plant, and machinery at micro level detail, along with Bar charts, essential for systematic and professional management of all construction works. The Employer's Representative will either approve the submittal or provide comments thereon to the Contractor within 14 days of

submission by the Contractor. The Employer's Representative's, approval, disapproval, comments, or failure to provide any of these to the Contractor, shall in no way relieve the Contractor of any of its obligations or responsibilities under the Contract."

Sub-Clause 4.19 Electricity, Water and Gas

Rename this Sub-Clause as "Electricity and Water"

Replace the entire text of Sub-Clause 4.19 with the following:

For performance of the Works Contract except Tests on Completion:

The Contractor shall be responsible for provision of all power, water, and other services he may require for performance of the Works Contract. This includes contacting the appropriate utility or service providers and applying for connections as necessary. At its sole discretion, the Employer may provide a water connection to the Contractor on an "as is" basis, with no guarantee of any kind provided regarding the quality, quantity, or availability of the water whatsoever. Should the Contractor choose to avail himself of this facility, he shall, at his own risk and cost, provide all piping, fittings, and other equipment necessary for his use and for metering of the water and any treatment needed. The Contractor shall pay the Employer for water consumed at the commercial rate as indicted in the Appendix to Tender. The Contractor is to ensure that the quality of Water remains suitable for the purpose for which it is intended.

For performance of Tests on Completion and the O&M Contract:

Provision of electricity during Tests on Completion and during the Operation and Maintenance Period shall be the responsibility of the Contractor.

Provision of water for any and all uses in the Works during the Operation and Maintenance period shall be the responsibility of the Contractor.

Sub-Clause 4.21 Progress Reports

Amend the first sentence to read as follows:

"Monthly Progress Reports, along with photographs depicting the progress achieved in the month, shall be prepared by the Contractor in a format approved by the Employer's Representative and the Employer and submitted to the Employer's Representative."

Delay in submitting the Monthly Progress Reports in the approved format within the stipulated time, the Contractor shall be levied a penalty of INR 10,000 per month.

Add the following sentence at the end of the Sub-Clause:

"The Special reporting requirements during the Operation and Maintenance Period shall be as specified in the Employer's Requirements."

CLAUSE 5 DESIGN

Sub-Clause 5.1 General Design Obligations

Replace the first sentence with the following sentence:

"The Contractor shall carry out, and be responsible for, the design of the Works, including any site surveys, subsoil investigations, materials testing, and all other things necessary for proper planning and design."

Add the following paragraphs at the end of this Sub-Clause:

"The Contractor shall establish a design liaison office at Visakhapatnam City within 28 days from the Commencement Date to facilitate preparation and submission of designs, drawings, construction documents, etc., for review and approval by the Employer's Representative. The design liaison office shall preferably be located near the Employer's office to facilitate communications and frequent interactions with the Employer's Representative and the Employer. The Contractor shall provide full-time design staff and continuously maintain the design liaison office until such time as all necessary designs and Construction Documents have been completed, reviewed, and approved by the Employer's Representative.

The Contractor will be fully responsible for ensuring that its designs, drawings, and construction documents satisfy all requirements for constructing Works that are complete and fully functional in all respects.

Sub-Clause 5.2 Contractor's Documents

In Sub-Clause 5.2 replace sub-paragraph (a) with the following:

"(a) The Contractor shall submit, within 14 days of signing the Contract Agreement, the proposed "Submission and Anticipated Approval Programme" for all necessary Contractor's Documents (such as resources required, productivity, deployment schedule) for approval by the Employer's Representative. Such Program shall ensure availability of all construction documents on site in a timely manner, which is essential for systematic and professional management of all construction works. The Employer's Representative will either approve the submittal or provide comments thereon to the Contractor within 14 days of submission by the Contractor. The Employer's Representative's, approval, disapproval, comments, or failure to provide any of these to the Contractor, shall in no way relieve the Contractor of any of its obligations or responsibilities under the Contract. Construction on any component of the Works shall not commence until the Contractor receives from the Employer's Representative approval of all Contractor's Documents relevant to the design and construction of the component. If the Employer's Representative fails to respond to a Contractor's Document at the end of 14 days, despite the Contractor's written reminder at the end of the 21-day "review period", then the Employer's Representative shall be deemed to have approved that Document."

Sub-Clause 5.4 Technical Standards & Regulations

Add the following sentence to the end of Sub-Clause 5.4:

"With respect to technical standards, National or International Standards other than those specified may be acceptable, subject solely to the Employer's Representative's approval."

CLAUSE 6 STAFF AND LABOUR

Sub-Clause 6.5 Working Hours

Add the following at the end of this Sub-Clause:

"The above applies to the Works Contract. For the O&M Contract, working hours shall be 24 hours per day, every day of every year within the O&M Period."

Sub-Clause 6.7 Health and Safety

Add the following paragraph after first paragraph:

"In the event of any outbreak of illness of an epidemic nature, the Contractor shall comply with and/or carry out all such regulations, orders, and/or requirements as may be applicable, including those imposed by various governments and the local medical or sanitary authorities."

Amend the last sentence of second paragraph to read as follows:

"Throughout the execution of the Works and the Operation and Maintenance Period, the Contractor shall provide whatever is required by this person to exercise this responsibility and authority."

Sub-Clause 6.8 Contractor's Superintendence

Add the following paragraph at the end of Sub-Clause 6.8:

"The Contractor shall submit, within 14 days of signing the Contract Agreement, the proposed Deployment Program for all key personnel as well as workers for superintendence of construction activities for approval by the Employer's Representative. Such Deployment Program shall show details of qualifications and experience of key personnel and the number of skilled/semi-skilled/unskilled workers to be deployed on a timeline, which is essential for proper superintendence and systematic and professional management of all construction works. The Employer's Representative will either approve the submittal or provide comments thereon to the Contractor within 14 days of submission by the Contractor. The Employer's Representative's, approval, disapproval, comments, or failure to provide any of these to the Contractor, shall in no way relieve the Contractor of any of its obligations or responsibilities under the Contract. At least seventy-five percent (75%) of the Contractor's Superintending staff shall have a working knowledge of the English language, or the Contractor shall have a sufficient number of competent interpreters available on site during all working hours."

None of the Contractor's Representative, supervisors, or labour staff shall be withdrawn from the Works without due notice being given to the Employer's Representative. Further, no such withdrawals shall be made if in the sole opinion of Employer's Representative, such withdrawals will jeopardize the progress and timely, successful completion of the Works.

Sub-Clause 6.10 Records of Contractor's Personnel and Equipment

Replace the last sentence of this Sub-Clause with the following:

"Details shall be submitted each calendar month, in a form approved by the Employer's Representative, until the Contractor has completed all work under both the Works Contract and the O&M Contract according to the terms of the Contract."

Add the following paragraph at the end of Sub-Clause 6.10:

"During the Operation and Maintenance Period, the Employer shall be notified of any changes to the Personnel or Equipment at the end of each calendar month"

Add the following Sub-Clauses under Clause 6 - Staff and Labour:

Sub-Clause 6.12 Foreign Staff and Labour

"The Contractor may employee such personnel as are required to execute the Works. The Contractor must ensure that all such personnel are provided with or otherwise obtain the required visas and work permits and comply with all legal requirements. The Contractor shall be responsible for all personnel who are foreign nationals for the duration of their engagement with the Contractor in connection with this Contract, and shall also be responsible for ensuring the return of such personnel at the end of the engagement to their previous engagement or domicile in or outside India."

Sub-Clause 6.13 Measures Against Insect & Pest Nuisance

"The Contractor shall at all times take the necessary precautions to protect all staff and labor employed on the Site from insect and pest nuisance, and to reduce the dangers to public health and the general nuisance occasioned by the same. The Contractor shall provide its staff and labor with suitable prophylactics for the prevention of malaria and dengue fever, and take steps to prevent the formation of stagnant pools of water. The Contractor shall comply with all the regulations of the local health authorities and shall arrange to spray thoroughly with approved insecticide all buildings erected on the Site. Such treatment shall be carried out at least once a year or as instructed by such authorities."

Sub-Clause 6.14 Alcoholic Liquors or Drugs

"The Contractor shall not, other than in accordance with the Statutes, Ordinances, Government Regulations, or orders that may be in effect from time to time, import, sell, give, barter, or otherwise dispose of any alcoholic liquor or drugs, or permit or suffer any such importation, sale, gift, barter, or disposal by his Subcontractors, agents, staff, or labor."

Sub-Clause 6.15 Arms and Ammunition

"The Contractor shall not give, barter, or otherwise dispose of any arms or ammunition of any kind or permit or suffer any such gift, barter or disposal by his subcontractors, agents, staff, or labor."

Sub-Clause 6.16 Festivals and Religious Customs

"The Contractor shall in all dealings with his staff and labor show due regard for all recognized festivals, days of rest, and religious or other customs."

CLAUSE 7 PLANT, MATERIALS, AND WORKMANSHIP

Sub-Clause 7.1 Manner of Execution

Replace the first sentence with the following:

The Contractor shall carry out the manufacture of Plant and or replacement and/or repair of the Plant, the production and manufacture of Materials, and all other execution of the Works and Operation and Maintenance:

Add the following paragraph at the end of Sub-clause 7.1:

"The Contractor shall submit, within 60 days of signing the Contract Agreement, the proposed Procurement Program for all necessary Equipment, Plant, and Materials (including but not limited to Pumps, Motors, Compressor, Surge Vessels, Piping, Electrical Equipment, Structural Steel, Cement, Reinforcement Steel, Fuels, Lubricants, Spare Parts, etc.) to be incorporated into the

Works for approval by the Employer's Representative. Such Procurement Program shall be developed using a normally available commercial project management software and shall show detailed planning and scheduling for placing of orders, inspections by the Contractor, Employer's Representative, Employer, and/or Third Party Agencies, as applicable, and transportation plans and delivery schedules for all Equipment, Plant, and Materials to be incorporated into the Works as essential for systematic and professional management of all construction works. The Employer's Representative will either approve the submittal or provide comments thereon to the Contractor within 15 days of submission by the Contractor. The Employer's Representative's, approval, disapproval, comments, or failure to provide any of these to the Contractor, shall in no way relieve the Contractor of any of its obligations or responsibilities under the Contract."

Sub-Clause 7.3 Inspection

Replace Sub-paragraph (b) of the first paragraph of Sub-Clause 7.3 with the following:

"during production, manufacture, and construction (at the Site and elsewhere), and during the O&M Period, be entitled to examine, inspect, measure, and test the materials and workmanship, and to check the progress of manufacture of Plant, production and manufacture of Materials, and Operation and Maintenance."

Employer may appoint third party for auditing, inspection and testing of the material and workmanship, and accounts or any other work done by contractor during design, construction and O&M period.

Sub-Clause 7.4 Testing

Delete the first sentence of the fourth paragraph "The Employer's Representative shall give the Contractor ... intention to attend the tests."

Sub-Clause 7.7 Employership of Plant and Materials

Add at the end of sub clause 7.7 **:**

Notwithstanding the provisions of the preceding paragraph of this Sub clause 7.7, the Contractor shall not be entitled to payment for Plant and Materials which are not in compliance with the Specifications or any other terms or requirements of this Contract.

Sub-Clause 7.8 Royalties

Replace Sub-Clause 7.8 with the following:

"Unless otherwise stated in the Employer's Requirements, and in accordance with the prevailing rules and rates specified by the Government of Andhra Pradesh, the Contractor shall pay all applicable royalties, rents, and other payments to the relevant parties for:

(a) all Equipment, Plant, and Materials used in the Works, and

(b) the disposal of material from demolitions and excavations and of other surplus materials (whether natural or manmade), except to the extent that disposal areas within the site are specified in the Contract.

Add the following Sub-Clause under Clause 7 - Plant, Materials, and Workmanship

Sub-Clause 7.9 Failure to Remedy Defects or to Complete Part of Works

"If the Contractor fails to remedy any defect in the Plant, Materials, design, or workmanship, or if the Contractor fails to complete any part of the Works deemed necessary by the Employer within a reasonable time after being notified by the Employer's Representative, the Employer or the Employer's Representative may fix a date on or before which to remedy the defect or damage or to execute the part of the Works in question to the satisfaction of the Employer's Representative, and give the Contractor reasonable notice of such date."

If the Contractor fails to remedy the defect or damage or to complete the required part of the Works by the specified date the Employer may (at his sole discretion):

(a) carry out the work himself or by others, in a reasonable manner, and at the Contractor's risk and expense; the costs properly incurred by the Employer in remedying the defect or damage or in executing part of the Works shall be recoverable from the Contractor by the Employer and will be calculated based on the direct cost of any labor, equipment, materials, superintendence, and other services provided by the Employer for carrying out such work, as certified by the Employer's Representative, plus an administration fee of twenty percent (20%) of the direct costs to cover overheads and other indirect costs; or

(b) require the Employer's Representative to determine and certify a reasonable reduction in the Contract Price; or

(c) if, in the sole opinion of the Employer, the defect, damage, or uncompleted work is such that the Employer has been deprived of substantially the entire benefit of the Works or parts of the Works, terminate the Contract with respect to such parts of the Works as cannot be put to the intended use: the Employer shall then be entitled to recover all sums paid for such parts of the Works, together with the cost of dismantling the same, clearing the Site, and returning Plant and Materials to the Contractor, and the provisions of Clause 15 [Termination by Employer] will apply."

The cost due to the items '(a)' to '(c)' will be recovered from the Contractor. This cost is in addition to the maximum delay damages of 10% of works contract price as indicated in Appendix to Tender.

CLAUSE 8 COMMENCEMENT DATE, COMPLETION AND PROGARMME

Add sub clause 8.9 Commencement of work as per below

"The Contractor shall commence the design of the Works as soon as is reasonably possible after receipt of the Notice of the Commencement Date from the Employer's Representative, but in any event not later than the earlier of (i) 14 days after establishing the design liaison office, or (ii) 30 days after issue of Notice of commencement date. The Contractor shall commence the execution of the Works as soon as is reasonably possible after receipt of a notice to this effect from the Employer's Representative, but in any event not later than the earlier of (i) 21 days after commencing establishment of the Site offices and field laboratories, or (ii) 60 days after issue of Notice to Commence."

"The Contractor shall commence the Operation and Maintenance services immediately after successful commissioning of the Works and issuance of the Taking-Over Certificate by the

Employer. The Works will be handed over back to the Contractor for the purpose of Operation and Maintenance."

Sub-Clause 8.2 Time for Completion

Replace the text of Sub-Clause 8.2 in its entirety with the following:

"The Contractor shall ensure that various components of the Works are executed in conformity with the Volume II Technical Specifications / Works requirement, and that the Works are fully completed within the Time for Completion specified in the Appendix to Tender.

The entirety of the Works shall be completed and shall have passed the Tests on Completion, trial run, and commissioning within the Time for Completion of the Works as specified in the Appendix to Tender. The Taking-Over Certificate will be issued upon successful completion of the Tests on Completion, trial run, and commissioning,

Operation and Maintenance of the Works shall be carried out for the Operation and Maintenance Period as specified in the Appendix to Tender."

The time for completion of the Project is 1Year (12 months) from the date of commencement of works. 3 months for the completion of the Design and 9 months for the completion of Construction and 120 months of Operation and maintenance including 24 months defect liability period.

Sub-Clause 8.3 Programme

Add the following at the end of Sub-Clause 8.3:

"Notwithstanding anything to the contrary in the above paragraphs of this Sub-Clause 8.3 or elsewhere in the Bid Documents, the Contractor shall be fully responsible for ensuring that the Works are fully completed within the Time for Completion of Works specified in the Appendix to Tender and in conformity with the Volume II Work requirement and technical specification. The Contractor shall submit, within 14 days of signing the Contract Agreement, the proposed Construction Program for approval by the Employer's Representative. Such Construction Program shall be developed using a normally available commercial project management software (such as Primavera, MS Project, or equivalent) and shall show detailed micro-level activities together with Gantt charts, CPM diagrams, critical paths, daily schedules, resources allocated, etc., as needed for systematic and professional management of all construction works. The Employer's Representative will either approve the submittal or provide comments thereon to the Contractor within 14 days of submission by the Contractor. The Employer's Representative's, approval, disapproval, comments, or failure to provide any of these to the Contractor, shall in no way relieve the Contractor of any of its obligations or responsibilities under the Contract.

In the event that the Contractor's actual progress falls behind the planned progress for reasons that are not outside the control of the Contractor, the Contractor shall accelerate his schedule to the extent required to ensure full completion of the Works within the Time for Completion of the Works, for which no additional payment will be made."

Sub-Clause 8.5 Delay Damages

Add the following after the first paragraph:

Delay damages will be linked to the Project Schedule and Milestone prepared by Contractor and mutually agreed by both parties, Client & Contractor" If the Contractor fails to provide Operation and Maintenance for the entire O&M Period specified in the Contract, and such failure:

(a) is due to a cause for which the Contractor is responsible, and

(b) results in the Employer losing revenue or income which the Employer normally would have expected to receive during the Operation and Maintenance Period, or

(c) results in the Employer suffering any other loss which he would not have suffered but for such failure, or

(d) results in inadequate treatment service and/or inadequate performance

then the Contractor shall pay to the Employer compensation in accordance with Sub-Clause 22.5 [*Delays and Interruptions during the Operation and Maintenance*]."

CLAUSE 9 DESIGN-BUILD

Sub-Clause 9.5 Rate of Progress

Add the following at the end of this Sub-Clause:

"The Contractor shall endeavour to advise the Employer in advance of any known or probable future events or circumstances which might adversely affect progress. The Employer may require the Contractor to submit an estimate of the anticipated effect of the future events or circumstances, and/or a proposal under Sub-Clause 13.3 [*Variation Procedure*]."

CLAUSE 11 TESTS

Sub-Clause11.4 Failure to Pass Tests on Completion of Design-Build

Replace the Second paragraph in its entirety with the following:

"In the event that the Works fail to pass any or all of the Tests on Completion as defined in Volume II, the Employer will levy Damages, based on the extent or magnitude of such failure, in accordance with the formulation provided in the Appendix to Tender.

If the following conditions apply:

(a) the Works, or a Section, fail to pass any or all of the Tests on Completion,

(b) the relevant sum payable as damages for such failure is stated (or its method of calculation is defined) in the Appendix to Tender, and

(c) the Contractor pays such relevant damages to the Employer

then the Works or such Section shall be deemed to have passed such Tests on Completion.

However, the total amount of Delay Damages for Works and Damages for failure to pass the Tests on Completion as defined in this Sub-Clause shall not exceed the maximum amount of 'Delay Damages for Works' stated in the Appendix to Tender."

The damages will be accessed by Independent Engineer/PMC on actuals

Sub Clause 11.7 Commissioning Certificate

Add the Following Sentence at the End of Clause

The Phrase "Taking Over Certificate" is synonymous with "Commissioning Certificate"

CLAUSE 12 DEFECTS

Sub-Clause 12.1 Completion of Outstanding Work and Remedying Defects

Add the following in the end of Sub-Clause 12.1:

During the Operation and Maintenance Period the Contractor shall be responsible for repairing and making good any damage or defect occurring during the Operation and Maintenance Period, whether such defect or damage is identified by the Employer's Representative / Employer or observed by the Contractor himself.

The Final Contract Completion Certificate on Completion of the Operation and Maintenance Contract described under Sub-Clause 8.6 will not be issued until all defects and damage have been remedied and all outstanding work, including all such items identified during the joint inspection made in accordance with Sub-Clause 11.8 [*Joint Inspection Prior to Contract Completion*] have been completed.

Sub-Clause 12.2 Cost of Remedying Defects

Add the following Sub-paragraph 12.2(c)

(c) Improper Operation and Maintenance attributable to the Contractor.

Add the following Sub-Clause 12.7

Sub-Clause 12.7 Completion of Operations and Maintenance Services

"In order that the Works shall be in the condition required by the Contract at the end of the Operation and Maintenance Period and can be handed over to the Employer in good operating condition (fair wear and tear excepted), the Contractor shall:

(a) ensure that all components of the Works are fully functional and in good operating condition, suitable for the purposes for which they are intended;

(b) ensure that all defects or damages which may have arisen from the design, workmanship, materials, or Operation and Maintenance, have been identified and remedied;

(c) provide replacements for all spare parts that were used/consumed during the Operations and Maintenance Period; all such replacements shall be new and manufacturer's original equipment only; and

(d) execute all required work of amendment, reconstruction, repair, and remedying of defects and damage per instructions of the Employer or Employer's Representative.

All such work shall be executed by the Contractor at his own cost before handing over the Works. In the event that the Contractor fails to carry out the necessary remedial works, the Employer's Representative shall notify the Contractor, and proceed in accordance with the provisions of. Any costs incurred by the Employer in so doing shall be recoverable from the Contractor and will become a debt due and payable by the Contractor to the Employer and the Employer may, at his sole discretion, recover such amount by invoking the Contractor's bank guarantee or by any amount due to contractor.

The Contract shall not be considered to be completed until the Final Contract Completion Certificate has been signed by the Employer's Representative and delivered to the Contractor, stating the date upon which the Contractor has completed his operation and maintenance obligations to the satisfaction of the Employer's Representative. The Final Contract Completion Certificate shall be given by the Employer's Representative within 28 days after the end of the Operation and Maintenance Period, or as soon after such date as the Contractor has completed his obligations.

Only the Final Contract Completion Certificate shall be deemed to constitute final certification that the Contractor has satisfactorily fulfilled all of his obligations under the Contract."

CLAUSE 13 VARIATIONS AND ADJUSTMENTS

Sub-Clause 13.8 Adjustment for Changes in Cost

Delete the text of Sub-Clause 13.8 in its entirety and replace it with the following:

13.8.1 The amount payable to the Contractor and valued at base prices in accordance with the payment Schedule shall be adjusted for rises or falls in the cost of Labor, Equipment, Plant, Materials and other inputs to the Works, by the addition or deduction of the amounts determined by the formulae prescribed in this Sub-Clause. To the extent that full compensation for any rise or fall in costs to the Contractor is not covered by the provisions of this or any other clause in the Contract, the Contract Price shall be determined to include amounts to cover the contingency of such other rise or fall in costs.

13.8.2 **Adjustment Formula**: The amount to be added to or deducted from the Interim Payment Certificates for changes in cost and legislation shall be determined from formulae for each of the currencies in which the Contract Price is payable and for each of the sections of work priced in the said Schedule. The formulae is given in Schedule 4.

The source of indices shall be those listed in the Appendix to Tender

13.8.3 **Base, Current and Provisional Indices:** The cost indices or reference prices specified in the Appendix to Tender, as approved by the Employer's Representative, shall be used. In cases where the Currency of Index is not the relevant currency of payment, the index shall be converted into the relevant currency of payment at the selling rate established by the Reserve Bank of India. If at any time a current index (for the date forty nine (49) days prior to the last date of the period to which the Special Interim Payment Certificate is related) is unavailable, a provisional index as determined by the Employer's Representative shall be used, subject to subsequent correction of the amounts certified when the current index is available.

13.8.4 **Weighting and Adjustment Factors:** The weightings (coefficients) for each of the factors of cost, unless otherwise provided by the Employer in the Bidding Document, shall be proposed by the Contractor, subject to approval by the Employer's Representative. The weightings shall be adjusted if, in the opinion of the Employer's Representative, the weightings are rendered unreasonable, unbalanced, or inapplicable as the result of changes in the methods of work, or as a result of varied or additional work already executed or ordered or for any other reason. The decision of the Employer's Representative shall be final and binding to the Contractor.

13.8.5 **Adjustable Amount**: The adjustable amount of each Interim Payment Certificate shall be the difference between (i) the amount which, in the opinion of the Employer's Representative, shall be due to the Contractor pursuant to Sub-Clause 13.7 including the amount at base rates and prices of the scheduled work carried out but excluding provisional sums and the value of

materials on site, and (ii) the amount as calculated in (i) above and included in the last preceding Interim Payment Certificate issued by the Employer's Representative. The adjustable amount shall exclude payments to nominated Sub-Contractors and any other amounts based upon actual cost or current prices.

13.8.6 **Adjusted Amount**: The adjusted amount of each Interim Payment Certificate shall be determined by applying the Price Adjustment Factor to the adjustable amount, and shall become payable to the Contractor in accordance with the provisions of Clause 13.7, subject to any deductions there from for retention money, delay damages, and any other monies due to the Employer from the Contractor including the recovery of the mobilization advance, if any.

13.8.7 **Adjustment due to Shortfall in Progress**: In the event the Contractor fails to attain the rate of progress, as per the approved program and schedule of progress, in the first or another quarter of the construction period and the shortfall in progress is covered up by him during subsequent quarters within the Intended Completion Period then the price adjustment of such work which was scheduled to be done in the previous quarter shall be notionally given based upon the price index of that quarter in which such work was required to be done.

13.8.8 **Failure to Complete Within the Time for Completion**: If the Contractor fails to complete the whole of the Works within the Time for Completion, adjustment of prices thereafter until the date of completion of the Works shall be made using either each index or price applicable on the date forty nine (49) days prior to the expiry of the Time for Completion, or the current index or price, whichever is more favorable to the Employer; provided that, if an extension of time is granted in accordance with Sub-Clause 8.3, the above provision shall apply only to the adjustment made after the expiry of such extension of time.

13.8.9 **Dates for Application of Changes in Cost:**

Work which is carried out during First Year (365 days) of the Works Contract Period will be carried out at the base rates and prices in accordance with the payment Schedule, and will not be subject to any adjustment for rises or falls in the cost of labor, equipment, plant, materials or other inputs to the Works. Increases or decreases in the cost of such inputs shall be adjusted on a monthly basis thereafter for the remaining works.

Add the following as Sub-Clause 13.9:

Sub-Clause 13.9 Amendments to the Contract Conditions/Specifications

"If the Employer determines that if, in exceptional circumstances, it would be in best interests of the Project to modify or amend some of the Contract Conditions/ Specifications, then such modifications or amendments may be made if mutually agreed by the Employer and the Contractor.

CLAUSE 14 CONTRACT PRICE AND PAYMENT

Sub-Clause 14.1 The Contract Price

Delete the text of Sub-Clause 14.1 in its entirety and replace it with the following:

"(a)Payment for the Works shall be made on a lump sum under major work categories as follow:

(i) Design Documentation Works, Piping Works, Civil works, installation, testing, commissioning of mechanical, electrical and instrumentation and control equipment required for the different components in accordance with the payment units as set out

in the Schedule of Prices and/or as proposed by the Contractor and approved by the Employer's Representative;

(ii) Plant and equipment, whether supplied from outside or within the Employer's country, including supply of all electro-mechanical, electrical and instrumentation equipment, mandatory spare parts, etc., for the different components according to the payment units as set out in the Schedule of Prices and/or as proposed by the Contractor and approved by the Employer's Representative; and

(iii) Operation and maintenance of the constructed facilities after completion and acceptance of the Works.

Selection of any of the recommended spare parts will be solely at the Employer's option, and payment for such spare parts, if any, will be made at the quoted unit rates.

(b) The Contract Price shall be adjusted for changes in the cost of labor and materials in accordance with the provisions of Sub-Clause 13.8 [*Adjustment for Change in Cost*] of this Appendix 1, Special Conditions of Contract.

(c) The Contractor shall pay all the duties and taxes in consequence of his obligations under the Contract, and the Contract Price shall not be adjusted for such costs, except as stated in Sub-Clauses 13.7[*Adjustment for Change in Technology*] and 13.8.

(d) Any quantities which may be set out in the Schedule are only estimated quantities and are not to be taken as the actual and correct quantities of the Works to be executed by the Contractor in fulfilment of his obligations under the Contract. The Contractor is responsible to assess the exact requirements and quantities for all items for the purpose of quoting his rates, and no variation in rates will be allowed on account of any variation in the estimated quantities.

(e) Any quantities, prices or rates of payment per unit quantity which may be set out in the Schedule are only to be used for the purposes stated in such Schedule.

Sub-Clause 14.2 Advance Payments

Delete the text of Sub-Clause 14.2 in its entirety and replace it with the following:

"The Employer will, if requested by the Contractor, make mobilization advance payments to the Contractor to assist in defraying the initial expenses that will necessarily be incurred by the Contractor for mobilization and design. The Mobilization Advance will be given to the Contractor as per bank interest rate. Mobilisation advance shall be claimed by the contractor within 120 days from the signing of contract.

The Advance payment will be made in three instalments. The First instalment shall be an amount equal to 2 % (two percent) of the contract price, the Second Instalment shall be equal to 3 % (three percent) of the contract price and the third instalment shall be equal to 5 % (five percent) of the contract price. Advance payment will be paid only after Contractor submitting unconditional and irrevocable Bank guarantee for an amount equivalent to 100 % (One Hundred percent) of such instalment.

The Employer's Representative shall issue an Interim Payment Certificate for the first instalment after (i) execution of the Form of Agreement by the parties hereto (ii) provision by the Contractor of the Performance Security in accordance with Sub-Clause 4.2. Such bank guarantee shall be

issued either by a Nationalized or Scheduled Bank located in India or a foreign bank through a correspondent bank located in India and acceptable to the Employer.

After the first instalment of the advance payment has been utilized as per the approved programme, and to the satisfaction of the Employer's Representative, the Contractor may then apply for the second instalment. The Employer will make payment of the Second instalment of the mobilization advance only after the Contractor has fulfilled the following conditions:

(a) Mobilized the Project Manager for the Contract.

(b) Established and staffed a functional design liaison office at Visakhapatnam city.

After the Second instalment of the advance payment has been utilized as per the approved programme, and to the satisfaction of the Employer's Representative, the Contractor may then apply for the Third instalment.

The Employer will make payment of the Third instalment after the Contractor has successfully fulfilled the following conditions:

(a) Mobilized the all survey and subsoil investigation crews to the Site and commenced the surveys and subsoil investigations.

(b) Submitted a list of proposed subcontractors and their respective agreements for approval by the Employer's Representative.

(c) Submitted the proposed "Submission and Anticipated Approval Program" for construction documents for approval by the Employer's Representative.

(d) Submitted the proposed construction programme for approval by the Employer's Representative.

(e) Submitted, for approval by the Employer's Representative, mobilization/ deployment schedules for:

(i) Contractor's key personnel required for managing, executing and supervising the Works,

(ii) Contractor's Plant, Machinery and Equipment required for executing the Works; and

(iii) Procurement Schedule for major materials and equipment to be incorporated into the Permanent Works.

(f) Submitted a Cash Flow Forecast for O&M for approval by the Employer's Representative.

(g) Actual deployment of: (i) such Personnel, (ii) Machinery and Equipment, and (iii) placing of orders for major materials and equipment to be incorporated into the Permanent Works, as per the approved deployment schedules.

(h) Established the fully furnished and functional Site office and filed laboratory.

The advance payments shall be used by the Contractor exclusively for mobilization expenses, as per the programme approved by the Employer's Representative. It is expected that the Contractor will also mobilize sufficient funds, which should normally be not less that the advance provided by the Employer, so that adequate cash flow is maintained at all times

during execution. The Contractor is required to maintain liquidity from its own sources, and the advance from the Employer is only intended to facilitate the Contractor's mobilization and enhance activities on Site.In case the advance payment is not utilized by the Contractor as per the approved programme and within the stipulated period to the satisfaction of the Employer's

Representative, default proceedings as per Clause 15 [*Termination by Employer*] of General Conditions, shall be initiated against the Contractor. In case any action is initiated against the Contractor under clause 15 (Termination by Employer), then the bank Guarantee with the Employer shall be encashed, without any prejudice to the provision of Contract

Bank Guarantee shall remain effective until the Advance payment have been repaid.

Each Instalment of advance payment shall be recovered from the IPC's at the rate of 15.0 % of the IPC value. The entire advance payment shall be recovered from the contractor with in 365 days from the signing of contract. In the event of the Contractor failure to make the repayment on time, the Employer will encash the Bank Guarantee for the advance payment. For the delay in repayment of the Advance payment, the contractor shall pay the interest to the Employer for each day of delay, such interest to be calculated at the rate of 18 % (Eighteen Percent) per annum.

If the Advance Payment has not been fully repaid prior to Termination under Clause 15, as the Case may be, the whole of the balance then outstanding shall immediately become due and payable by the Contractor to the Client. In the event of Termination for Contractor Default, the Advance Payment shall be deemed to carry interest at the rate of 10% (ten per cent) per annum from the date of Advance Payment to the date of recovery by encashment of the Bank Guarantee for the Advance Payment. For the avoidance of doubt, the aforesaid interest shall be payable on each instalment of the Advance Payment, regardless of whether the instalment or any part thereof has been repaid to the Authority prior to Termination.

Sub-Clause 14.3 Application for Interim Payment Certificate

Delete the text of this Sub-Clause and replace with the following:

14.3.1: Interim Payment Certificate for Works

The Contractor shall submit a statement in six copies to the Employer's Representative after the end of each month in a form approved by the Employer's Representative, showing the amounts to which the Contractor considers himself to be entitled together with supporting documents which shall include the detailed report of progress during the month in accordance with Sub-Clause 4.21 [*Progress Reports*]. ***In case of supplied plant and equipment, inspection and testing clearance certificates shall also be enclosed as support documents***. The statement shall include the following items, as applicable, which shall be expressed in the various currencies in which the Contract Price is payable, in the sequence listed:

(a) the estimated contract value, at base rates and prices, of the Construction Documents produced and the Works (including variations) executed up to the end of the month.

(b) any amounts to be added and deducted for changes in legislation and Adjustments in cost in accordance with Sub-Clauses 13.6[*Adjustments for Changes in Legislation*] and 13.8 [*Adjustments for Changes in Cost*];

(c) any amount to be deducted for retention, calculated by applying the percentage of retention stated in the Appendix to Tender to the total of the above amounts, until the amount so retained by the Employer reaches the limit of Retention Money (if any) stated in the Appendix to Tender;

(d) any amounts to be added and deducted for the advance payments and repayments in accordance with Sub-Clause 14.2 [*Advance Payment*];

(e) any amounts to be added or deducted for Plant and Materials in accordance with Sub-Clause 14.6 [Payment for *Plants and Materials Intended for the Works*];

(f) any other additions or deductions which may have become due in accordance with the Contract (including those under Clause 20 –Claims, Disputes and Arbitration), other than under Sub-Clause 8.5 [*Delay Damages*]; and

(g) the deduction of the amounts certified in all previous Interim Payment Certificates.

14.3.2: Interim Payment Certificates for Operation and Maintenance

The Contractor shall submit a statement in six copies to the Employer's Representative after the end of each month, in a form approved by the Employer's Representative, showing the amounts of Expenditure and revenues with supporting documents. The Statement shall include the following items as applicable:

(a) the expenditure value of the operation and maintenance services of the facilities up to the end of the month;

(b) The revenue generated on account of user fee collection and advertising right at the end of the month.

(c) any other additions or deductions which may have become due in accordance with the Contract (including those under Clause 20–Claims, Disputes and Arbitration), other than under Sub-Clause 8.5 [*Delay Damages*]; and

(d) the deduction of the amounts certified in all previous Interim Payment Certificates."

Change the heading of Sub-Clause 14.4, Schedule of Payments, to read as Sub-Clause 14.4, Interim Valuation

Sub-Clause 14.4 Interim Valuation

Delete the text of this Sub-Clause and replace it with the following text:

14.4.1 'Prior to commencing construction of the Permanent Works, the Contractor shall submit a Bill of Principal Quantities of the Permanent Works" including provision for construction, installation, testing, trial run and commissioning (referred to in this Sub-Clause as "the BPQPW") together with such supporting information and calculations as the Employer's Representative may reasonably require. The BPQPW shall include the anticipated final quantities of the principal items of Permanent Works, which shall have been priced using all-in rates such that the total amount equals the Works Contract Price. The BPQPW shall not contain priced items for design (other than as may be specified in the Schedule of Prices) or for Temporary Works; the value of each element of such work, and of any other work elements not

described in the BPQPW, shall each be included in the rates for Permanent Works to be constructed after such element is carried out. The BPQPW shall be subject to the approval of the Employer's Representative, which may at any time be withdrawn, and shall be without prejudice to the final amount due under the Contract. The BPQPW shall be revised and reissued if it appears at any time before Taking-Over that it will not fully represent the Permanent Works when complete.

During the Time for Completion, the contract value for the purpose of sub-paragraph (a) of Sub-Clause 14.3.1 shall not exceed the amount calculated from the current BPQPW, based on the quantities of Permanent Works which have been constructed in accordance with the Contract. The Contractor's interim statement shall be in the same form as that of the current BPQPW and shall be accompanied by the Contractor's signed statement that the current BPQPW attached thereto (including anticipated final quantities) and the as-constructed quantities are all correct; each such statement shall also be accompanied by a Construction Certificate, signed by the Contractor's Representative, certifying that the part of the Works constructed to date complies with the Contract. However, the Contractor may propose such lesser amount as seems reasonable, supported with appropriate calculations on a similar basis to the procedure described in this Sub-Clause.

14.4.2 **Procedures for Interim Valuations:** The above procedures notwithstanding, interim valuations for the purposes of determining payments to be made to the Contractor by the Employer will be made on a progressive basis,

14.4.3 Payment against any physical work, procurement of material and equipments, plants etc. Payment against commissioning shall be made only after successful commissioning of the entire package. No payment will be made against part commissioning.

14.4.3 Payment for the works shall be made in accordance with Payment Schedule approved by Employer. The Contractor shall submit the measurements of Executed works in measurable units as per standard procedure of measurement books. Increase or decrease in physical quantity of lumpsum item for which rate has been quoted will not be considered for change in rate and the rate will remain constant for any variation in such quantities.

14.4.4 The Contractor shall submit the Payment Schedule for the approval of the Employer. Payment Schedule will be linked with project schedule and milestone prepared by Contractor and mutually agreed by both parties, Employer & Contractor

Sub-Clause 14.6 Payment for Plant and Materials Intended for Works

In the first sentence of Sub-Clause 14.6, delete the phrase "If this Sub-Clause applies,"

Sub paragraph (b) does not apply to this contract

Sub paragraph (c)(i) is amended to read as follows:

"(c)(i) are considered to be in accordance with the Contract, have passed any required pre-delivery inspections and tests, and have successfully passed any required third party inspections and are those listed in the Appendix to Tender for payment when delivered to site; and ."

Paragraph (c)(ii) is amended to read as follows:

"(c)(ii) have been delivered to the Site in accordance with the approved programme and delivery schedule, have passed any required inspections and/or tests on delivery, and are properly

stored on the Site and protected against loss, damage or deterioration and appear to be in accordance with the Contract."

Fourth Paragraph is amended to read as follows:

The additional amount to be certified shall be equivalent to Seventy Five (75 %) of the amount claimed by the contractor for such plants and materials delivered to site, after review of the documents mentioned in this Sub clause, taking account of the contract value of Such Plants and Materials as determined and appropriate by the Employer's Representative. Payment will be done only after contractor submitting the bank guarantee of amount equal to such certified amount.

Plant & Material delivered to site should be as per Project Requirement & Project Schedule, and will be verified and certified by PMC

Sub-Clause 14.7 Issue of Advance and Interim Payment Certificates

Delete the last sentence of the second paragraph 'in this event, the Employer's Representative shall give notice to the Contractor accordingly.'

Insert the following paragraph before the last paragraph in this Sub-Clause:

"In continuation to the first paragraph of this Sub-Clause 14.7, the Contractor will be permitted to submit monthly claims for payment for work, subject to the claim having a minimum value as indicted in Appendix to Tender. If requested by the Contractor, the Employer's Representative shall, within 3 (three) days of receiving the statement and supporting documents confirming that the work has been executed, and after having satisfied himself as to the acceptability of the claim, deliver to the Employer with a copy to the Contractor an Advance Interim Payment Certificate in an amount of 80% (eighty percent) of the amount claimed by the Contractor. The Employer's Representative shall subsequently, within the time set forth in the first paragraph of this Sub-Clause, deliver to the Employer with a copy to the Contractor an Interim Payment Certificate for the balance amount which the Employer's Representative considers to be due. All relevant deductions or adjustments, as set out in Sub-Clause 14.3.1, shall be applied to such Interim Payments, and any amounts that are to be deducted for advance repayments shall be adjusted on a pro-rata basis.

In the event that the Employer's Representative determines to its satisfaction that the Contractor is abusing the privilege of availing the Advance Interim Payment Certificate by submitting false claims for any work that has not been done, then the Contractor will be subject to a penalty or penal actions in accordance with the following:

(a) for the first offence, a penalty of Rs, 100,000 (Rupees one hundred thousand) which will be deducted from the amount approved under the Interim Payment Certificate;

(b) for the second offence, a penalty of Rs. 200,000 (Rupees two hundred thousand) which will be deducted from the amount approved under the Interim Payment Certificate;

(c) for the third offence a penalty of Rs. 500,000 (Rupees five hundred thousand) which will be deducted from the amount approved under the Interim Payment Certificate, accompanied by withdrawal of the entitlement for submitting monthly bills and receiving Advance Interim Payment Certificates."

Sub-Clause 14.9 Delayed Payments

Delete the paragraph and replace it with the following paragraph:

"If payment of any sum payable under Sub-Clause 14.8 is delayed, the Contractor shall be entitled to receive interest on the unpaid amount during the period of delay. Interest will be calculated from the date by which the payment should have been made at the rate of interest per annum stated in the Appendix to Tender. The Contractor shall be entitled to such payment without formal notice and without prejudice to any other right or remedy."

Sub Clause 14.10 Payment of Retention Money

Rename this Sub-Clause as "Payment of Retention Money for Works"

Append the following paragraph in the end:

Notwithstanding anything stated in the preceding paragraphs, at the request of the Contractor, entire amount of the Retention Money will be released at the issue of Taking Over Certificate.

Sub-Clause 14.13 Application for Final Payment Certificate Operation Service

Add the following paragraph at the end of this Sub-Clause:

"Within 56 days of receiving the Final Contract Completion on Completion of the Operation and Maintenance, the Contractor shall submit to the Employer's Representative, six copies of the a draft Final Statement for Operation and Maintenance with supporting documents showing in detail in a form approved by the Employer's Representative:

(a) the value of all work done in Operation and Maintenance, and

(b) any further sums which the Contractor considers due to him under the Contract or otherwise in relation to the Operation and Maintenance.

If the Employer's Representative disagrees with or cannot verify any part of the draft final statement, the Contractor shall submit such further information as the Employer's Representative may reasonably require and shall make such changes in the draft as may be agreed between them. The Contractor shall then prepare and submit to the Employer's Representative the final statement on Operation and Maintenance as agreed. This agreed statement on Operation and Maintenance is referred to in these Conditions as the "Final Statement on Operation and Maintenance".

However, if following discussions between the Employer's Representative and the Contractor and any changes to the draft final statement on Operation and Maintenance which are agreed, it becomes evident that a dispute exists, the Employer's Representative shall deliver to the Employer (with a copy to the Contractor) an Interim Payment Certificate for the agreed parts of the draft final statement on Operation and Maintenance. Thereafter, if the dispute is finally resolved under Sub-Clause 20.6 [*Obtaining Dispute Adjudication Board's Decision*] or Clause 20.7 [*Amicable Settlement*], the Contractor shall then prepare and submit to the Employer (with a copy to the Employer's Representative) a Final Statement."

Sub-Clause 14.17 Currencies of Payment

Delete the entire text of first paragraph Sub-Clause 14.17 and replace it with the following:

The Contract Price shall be paid in the currency or currencies named in the Appendix to Tender or as agreed by both the Parties.

Delete the entire text of sub paragraph (a) of this Sub-Clause 14.17.

CLAUSE 17 RISK ALLOCATION

Sub-Clause 17.5 Contractor's Care of the Works

Add the following in the end of Sub-Clause 17.5

The Contractor shall also be responsible for the care of the Facilities during the Operation and Maintenance Period in accordance with the requirement of the License Agreement Notwithstanding anything to the contrary stated in the Contract, the Contractor shall also be responsible for any part of the Works for which Taking-Over Certificate is issued.

The Contractor shall also take full responsibility for any outstanding work which he shall have undertaken to complete during the Operation and Maintenance Period until all such outstanding work is completed.

Subject to the provisions of Sub-Clause 17.8 [*Limitation of Liability*], the Contractor's Risks during the Operation and Maintenance Period are:

(a) all risks resulting or arising from the design or construction of the Works, or the Materials used therein, notwithstanding any testing carried out by or approved or witnessed by the Employer's Representative; and

(b) all risks resulting or arising from the operation and maintenance of the Facilities and the care of the Facilities excluding the Employer's Risks listed under Sub-Clause 17.3 [*Employer's Risks*].

Sub-Clause 17.12 Risk of Infringement of Intellectual and Industrial Property Rights

Delete the Second paragraph 'Whenever a party …….any right to indemnity under this Sub clause.

Add the following Sub-Clause 17.13

Sub-Clause 17.13 Occupation and Care of Employer's Facilities

"The Contractor occupying the Employer's facilities temporarily for the purpose of the Contract shall take full responsibility, from the dates of use or occupation to the dates of handover or cessation of occupation, of the items which are described, if any, in Volume II Technical Specifications/ Works requirements. If any loss or damage happens to any of the occupied facilities while the Contractor is responsible for their care, arising from any cause whatsoever other than the Employer's Risks listed in Sub-Clause 17.3, the Contractor shall, at its own cost, rectify such loss or damage to the satisfaction of the Employer's Representative. All temporarily occupied facilities shall be handed over upon completion of the Works, or on such other date as is mutually agreed, in the same or better condition than when they were given into the Contractor's care, normal wear and tear is accepted."

The Contractor shall be liable for any loss or damage caused by any actions performed by the contractor after a Taking over certificate has been issued. The Contractor shall also be liable for any loss or damage which occurs after a Taking over certificate has been issued and which arose from a previous event for which the Contractor was liable.

CLAUSE 20 CLAIMS, DISPUTES AND ARBITRATION

Add the Following

Modify Clauses 20.3, 20.4, 20.5, 20.6, 20.7, 20.8, 20.9, 20.10, 20.11 as follows

a. No Dispute can be raised except before the Competent Authority as defined in contract data in writing giving full description and grounds of dispute. It is clarified that merely recording protest while accepting measurement and / or payment shall not be taken as raising a dispute.

b. No dispute can be raised 45 days of its first occurrence. Any dispute raised after expiry of 45 days of its first occurrence shall not be entertained and the Employer shall not be liable for claims arising out of such dispute.

c. The dispute shall be addressed as mentioned as per the Arbitration and Reconciliation Act 1996.

d. The contractor shall have to continue execution of the work with the due diligence not withstanding pendency of a dispute before any authority or forum.

Implementation of Clause 20.1 & 20.2 will be as per procedure as mentioned above.

ADD THE ADDITIONAL CLAUSE AND SUB CLAUSES

CLAUSE 21 TAXATION

Sub-Clause 21.1 Foreign Taxation

"The prices bid by the Contractor shall include all taxes, duties and other charges imposed outside the Employer's country on the production, manufacture, sale and transport of the Contractor's Equipment, Plant, materials and supplies to be used on or furnished under the Contract and on the services performed under the Contract."

Sub-Clause 21.2 Local Taxation

(i) The price bid by the Contractor shall include all applicable duties/taxes. The taxes and duties portion shall be indicated separately in the price schedule. Nothing in the Contract shall relieve the Contractor from his responsibility to pay any tax that may be levied in India on profits made by him in respect of the Contract. The Contractor shall be deemed to be familiar with the tax laws of India.

Employer will provide all necessary support for admissible exemption, if any, for any kind of Tax or Duty.

Sub-Clause 21.3 Income Taxes on Staff

"The Contractor's staff and labor will be liable to pay personal income taxes in the Employer's country in respect of such of their salaries and wages as are chargeable under the laws and regulations for the time being in force, and the Contractor shall perform such duties in regard to such deductions thereof as may be imposed on him by such laws and regulations."

Any expatriate staff or staff not normally resident in India, employed by the Contractor shall pay personal income Tax on all money earned and paid in India.

Sub-Clause 21.4 Tax Deduction at Source (TDS)

Tax shall be deducted at the source from the payments made to the Contractor as per the Applicable Law / Statute

Sub-Clause 21.5 Duties on Contractor's Equipment

"Notwithstanding the provisions of Sub-Clause 4.17 [*Contractor's Equipment*], including essential spare parts thereof, imported by the Contractor for the sole purpose of executing the Contract, shall be temporarily exempt from the payment of import duties and taxes upon initial importation, provided the Contractor shall post with the customs authorities at the point of entry an approved export bond or bank guarantee, valid until the time of completion of the Contract plus six months, in an amount equal to the full import duties and taxes which would be payable on the assessed imported value of such Contractor's Equipment and spare parts, and callable in the event that the Contractor's Equipment is not exported from the Employer's country on completion of the Contract. A copy of the bond or bank guarantee endorsed by the customs authorities shall be provided by the Contractor to the Employer upon the importation of individual items of Contractor's Equipment and spare parts.

Upon export of individual items of Contractor's Equipment or spare parts, or upon completion of the Contract, the Contractor shall prepare, for approval by the customs authorities, an assessment of the residual value of the Contractor's Equipment and spare parts to be exported, based on the depreciation scale(s) and other criteria used by the customs authorities for such purposes under the provisions of the applicable law. Import duties and taxes shall be due and payable to the customs authorities by the Contractor on (a) the difference between the initial imported value and the residual value of the Contractor's Equipment and spare parts to be exported; and (b) on the initial imported value of that Contractor's Equipment and spare parts remaining in the Employer's country after completion of the Contract.

Upon payment of such dues within 28 days of being invoiced, the bond or bank guarantee shall be reduced or released accordingly; otherwise the security shall be called in the full amount remaining."

CLAUSE 22 OPERATION and maintenance

Sub-Clause 22.1 General Requirements

The Contractor shall comply with the Operation Management System as provided for in the Contract and any revisions thereof which are agreed during the Contract Period. The Contractor shall follow the requirements of the Operation and Maintenance Plan and the Operation and Maintenance Manuals. No significant alteration to such arrangements and methods shall be made without the prior approval of the Employer's Representative.

The Plant Contractors and maintenance personnel shall have the appropriate experience and qualifications to perform the Operation and Maintenance service as required under the Contract. The names, with details of their qualifications and experience, of all operation and maintenance personnel shall be submitted to the Employer for approval, and no such personnel shall be engaged prior to receiving such approval.

Sub-Clause 22.2 Commencement of Operation and Maintenance

The Operation and Maintenance shall not commence until the Works have been completed in accordance with the Contract and Taking-Over Certificate has been issued in terms of the Contract.

Should the Works Contract Completion Certificate or any notice attached or pertaining thereto, contain requirements or restrictions over and above those in the Contract, the Contractor shall comply with such requirements and/or restrictions, and, to the extent that the Contractor suffers additional Cost as a result, he shall be reimbursed by the Employer.

The Contractor shall thereafter provide the Operation and Maintenance service in compliance with the Operation Management System and in accordance with As-Built Documents and the Operation and Maintenance Manuals.

If the Contractor wishes to modify a document which has previously been submitted and approved, the Contractor shall immediately notify the Employer's Representative, and shall subsequently submit revised document(s) to the Employer's Representative for review accompanied by a written explanation of the need for such modification.

The Contractor shall not implement any proposed modification until such modification has been reviewed by the Employer's Representative, and consent to proceed has been given in writing. However, any such approval or consent, or any review (under this Sub-Clause or otherwise), shall not relieve the Contractor from any obligation or responsibility.

Sub-Clause 22.3 Delivery of Raw Materials

The Contractor shall be responsible for the supply and delivery to the Site (or other designated place) of the chemicals, fuels, consumables and other such items specified in the Employer's Requirements. The Contractor shall be responsible that all such items are fit for purpose and comply with the requirements of the Contract in respect of quality, purpose and function.

In the event that any such item or product is not delivered in accordance with the agreed delivery programme or deviates from the specified quality, and such delay or deviation causes the Contractor to suffer additional cost, the Contractor shall not be entitled for any extra costs which he has incurred.

Sub-Clause 22.4 Training

The Contractor shall carry out the training of Employer's Personnel in the Operation and Maintenance of the Facilities to the extent specified in the Employer's Requirements.

The programme and scheduling of the training shall be agreed with the Employer, and the Contractor shall provide experienced training staff, and all training materials as stated in the Employer's Requirements. The Employer shall be responsible for nominating and selecting suitable personnel for training.

Sub-Clause 22.5 Delays and Interruptions during Operation and Maintenance

Delays and interruptions during the Operation Service will be agreed and determined as follows:

(a) delays or interruptions caused by the Contractor

If there are any delays or interruptions during the Operation and Maintenance service which are caused by the Contractor or by a cause for which the Contractor is responsible, the Contractor shall compensate the Employer for any losses including loss of revenue, loss of profit, and overhead losses. The amount of compensation due shall be agreed according to Sub-Clause 3.5 [*Determinations*], and the Employer shall be entitled to recover the amount due by making a corresponding deduction from the next payment due to the Contractor. However, the total amount of compensation payable by the Contractor to the Employer shall not exceed the amount stated in the **Appendix to Tender.**

(b) suspension by the Employer

The Employer's Representative may at any time during the Operation and Maintenance instruct the Contractor to suspend progress of the Operation and Maintenance. During such suspension, the Contractor shall protect, store, secure and maintain the Facilities against any deterioration, loss or damage.

If the need to suspend the Operation and Maintenance by the Employer is due to any failure of the Contractor or circumstances for which the Contractor is responsible under the Contract, the provisions of paragraph (a) of this Sub-Clause shall apply.

If the need to suspend the Operation and Maintenance is not as a result of any failure by the Contractor or is due to circumstances for which the Contractor is not responsible under the Contract, the provisions of paragraph (b) of this Sub-Clause shall apply.

If a suspension which is not due to any failure by the Contractor or is due to circumstances for which the Contractor is not responsible under the Contract has continued for more than 84 days, the Contractor may request the Employer's Representative's permission to proceed. If the Employer's Representative does not give permission within 28 days after being requested to do so, the Contractor may give notice of termination under Sub-Clause 16.2 [*Termination by Contractor*].

After the permission or instruction to proceed is given, the Contractor and the Employer's Representative shall jointly examine the Facilities. The Contractor shall make good any deterioration or defect in the Plant and the Employer's Representative shall make a written record of all making good required to be carried out by the Contractor. If the suspension is not due to any failure by the Contractor or is due to circumstances for which the Contractor is not responsible under the Contract, the Contractor shall be entitled to be paid only after approval from the Employer the amount required for making good the Facilities prior to re-commencing the Operation and Maintenance

Sub-Clause 22.6 Failure to Maintain Compliance with Quality requirements

In the event that the Contractor fails to achieve and maintain compliance with the Specified quality requirements specified in the Contract, the Contractor and Employer shall jointly establish the cause of such failure.

(a) If the cause of the failure lies with the Contractor then, after due consultation with the Employer, the Contractor shall take all steps necessary to achieve and maintain compliance with the effluent quality requirements specified in the Contract.

If the Employer suffers any loss as a result of the failure or the measures taken by the Contractor, the Contractor, subject to Sub-Clause 3.5 [*Determinations*], shall pay the Employer performance damages as stipulated in Appendix to Tender**.**

Unless otherwise stated in the Contract, if the failure continues for a period of more than 15 days, and the Contractor is unable to achieve compliance with the specified quality requirements specified in the Contract, the Employer may:

(i) either continue with the Operation and Maintenance with the deduction in the Contractor's monthly payment as stated in Appendix to Tender or

(ii) give the Contractor 30 days' notice in writing and terminate the Contract. In such an event, the Employer shall be free to continue the Operation and Maintenance himself or by others.

Sub-Clause 22.7 Completion of Operation and Maintenance

Unless the Parties have mutually agreed to extend the Operation and Maintenance Period, the obligation of the Contractor to operate and maintain the Facilities under the Contract shall cease at the end of the period stated in the Contract as the Operation and Maintenance Period.

Notwithstanding the foregoing, other services required to be performed by the Contractor must be completed before the Contractor will be entitled to receive the Final Contract Completion Certificate on Completion of the Operation and Maintenance Period in accordance with Sub-Clause 10.6 of this Contract.

Pre-conditions which must be fulfilled by the Contractor before the Final Contract Completion Certificate on Completion of the Operation and Maintenance Period will be issued are:

(a) Inspection in accordance with Sub-Clause 11.8 [*Joint Inspection Prior to Contract Completion*],

(b) Testing in accordance with Sub-Clause 11.9 [*Procedure for Tests Prior to Completion*],

(c) Updating Operation and Maintenance manuals and providing performance records and data in accordance with Sub-Clause 5.6 [*Operation and Maintenance Manuals*], and

(d) Remedying defects found during inspection in accordance with Sub-Clause 11.8 [*Joint Inspection Prior to Contract Completion*].

Sub-Clause 22.8 Operating License

The Employer shall issue to the Contractor the Operating License or equivalent legal authorization to enable the Contractor to operate and maintain the Facilities during the Operation and Maintenance Period.

The Operating License shall automatically come into full force and effect upon issue of the Completion Certificate upon completion of the execution of the Works and successful commissioning of the parking system in accordance with the Contract and issuance of the Taking-Over Certificate.

The Operating License shall only extend to those parts of the Site which it is required to occupy for the purposes of carrying out the Works and Operation and Maintenance as set out in the Contract. The Operating License granted pursuant to this clause shall not operate nor be deemed to operate as a tenement or a demise of the Site or any part thereof. The Contractor shall not have or be entitled to any estate, right, title or interest in the Site / Facilities. The license will immediately terminate upon termination of this Contract for whatever reason.

CLAUSE 23 STATUTORY COMPLIANCE

The law of the place of the work shall govern the work of the Contract. The Contractors shall be responsible for all work & shall comply to the requirements of all applicable Central (Federal), State & Local Laws, Ordinances, guidelines, rules

CLAUSE 24 CHANGE OF SCOPE

Change of Scope shall means:-

a. change in specifications of any items of works

b. any additional works, Plants, Materials or Services which are not included in the scope of the project, including any associated tests on completion of Works

In the event the Employer determining that a change of scope is necessary, it may direct the Engineer to issue " Change of Scope" notice to the Contractor, specifying the details of works & services to be undertaken. On receiving the "Change of Scope" notice, the contractor shall provide to the employer information such as

a. Break down of quantities, unit rates and cost for different items of works

b. Proposed modification, if any, to project completion schedule.

No change of scope shall be executed unless the employer has issued change of Scope Order to the contractor.

Total value of all change of Scope orders shall not exceed Ten (10) percent of Approved

Contract Amount

TERMS AND PROCEDURES OF PAYMENT

Terms of Payment

1.1 General

In accordance with the provisions of GC, the Employer shall pay the Contractor in the manner and at the times set out in this Terms and Procedures of Payment Appendix.

1.2 Payment during the Design-Build Period

In respect of the amount for Design-Build Services listed in Price Schedule of the Contractor's Bid (the "Design-Build Price") for all current portions, the Employer shall make the payments as per the Clause 14 of Contract Price

1.3 Payment during the Operation Period

As per the price schedule.

1.4 Currencies

Payments will be made by the Employer in the currencies and as quoted by the Contractor in the Price Schedule of the Contractor's Bid, unless otherwise agreed between the Parties.

PAYMENT PROCEDURES

The procedures to be followed in applying for certification and making payments shall be as follows:

(1) During the Design-Build Period, payment shall be dealt with in accordance with progress achieved for Design built services, and

(a) During the Operations Period, the Contractor shall deliver an invoice no later than 15 days after the end of the 30 day period to which the invoice applies. If the End Date falls on a date that makes the Contractor's last period of operation less than 30 days, the Contractor shall submit an invoice that pro-rates the Monthly Operations Payment based on the number of days that the Operations Services were provided in the final period of operations.

Section IXA: APPENDIX TO TENDER

[NOTE: *With the exception of the items for which the Employer's requirements have been inserted, the following information must be completed before the Tender is submitted*].

Item	Sub clause no.	Data
Employer's Name and Address	1.1.32	Greater Visakhapatnam Smart City Corporation Limited (GVSSCL) Tenneti Bhavan, Ram Nagar, Visakhapatnam, Andhra Pradesh - 530003, India
Contractor's Name and Address	1.1.17	
Engineer's Name and Address	1.1.35	To be determined by Employer
Time for Completion of Works	1.1.78(i)	The work shall be completed within Twelve (12) months including rainy season from the date of issue of work order.
Time for Operation and Maintenance	1.1.78(ii)	Operation & Maintenance Period will commence after issue of completion certificate.
Defects Liability Period		For a Period of Two Year (2Years) after issuing commissioning certificate for entire works.
Section	1.1.70	Section does not apply for this contract. The whole of the Work shall be completed within the Time for Completion of Works.
Electronic transmission systems	1.3	Facsimile transmission will be acceptable form of electronic transmission system. As an alternate E-mail will also be acceptable form of electronic transmission system, provided signed written communication in hard copy is also received within seven (7) days of the transmission of an E-mail.
Governing Law	1.4	Law of Republic of India & Govt. of Andhra Pradesh.
Ruling Language	1.4	English
Language of Communication	1.4	English

Item	Sub clause no.	Data
Amount of Performance Security	4.2	Ten (10) Percent of Accepted Contract Amount
Return of Performance Security	4.2	Half of the performance security shall be released after issue of completion certificate & Balance half of the Performance security shall be paid after completion of contract i.e completion of Operation and maintenance period.
Electricity and Water	4.19	The contractor shall make his own arrangement for Electricity and water during construction testing & commissioning of the project.
Normal working hours	6.5	As per prevailing norms in State of Andhra Pradesh
Delay Damages for Works	8.5	Five Percent (5 %) of the cost of incomplete work of each milestone per month / as per project schedule. However if the contractor catches with the progress of work the same will be released in Interim Payment Certificates on contractor achieving subsequent milestone(s)
Maximum amount of Delay damages	8.5	10% of the **Works Contract Price.**
Liquidated Damages for Failure to Pass the Tests After Completion.	11.4	In the event that the Works fail to pass any or all of the Tests After Completion as defined in the Specifications- Volume II and as per relevant codes, then the Employer shall levy Liquidated Damages, based on the extent of such failure, subject to the condition that the total amount of Delay Damages for Works and/or Liquidated Damages for failure to pass the Tests After Completion shall not exceed the Limit of Delay Damages as defined in Sub-clause 8.5 above: The damages will be assessed by Third Party/Independent Engineer/PMC on actuals
Power Consumption:	All Payments during operation & maintenance period relating to the power consumption, to operate the system shall be borne by the contractor.	

<table>
<tr><th>Item</th><th>Sub clause no.</th><th>Data</th></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td>Adjustment for change in cost: Coefficients</td><td>13.8</td><td>
<table>
<tr><td>Coefficient</td><td>Description of Coefficient</td><td>Weightage</td></tr>
<tr><td>(a)</td><td>Fixed Coefficient</td><td>15</td></tr>
<tr><td>(b)</td><td>Labour</td><td>20</td></tr>
<tr><td>(c)</td><td>Material</td><td>60</td></tr>
<tr><td>(d)</td><td>Fuel</td><td>05</td></tr>
<tr><td></td><td>TOTAL</td><td>100</td></tr>
</table>
</td></tr>
<tr><td>Source of Indices</td><td>13.8</td><td>
<table>
<tr><th>Type of Index</th><th>Source</th></tr>
<tr><td>Cost Index of Labour</td><td>The average consumer price index for industrial workers as Notified by Reserve Bank of India .The base date shall be the date (30) days prior to bid closing date)</td></tr>
<tr><td>Cost Index for Material
(All commodities)</td><td>The average Whole sale price index for all commodities as Notified by Reserve Bank of India for India. The Base date shall be date thirty (30) days prior to bid closing date</td></tr>
<tr><td>Cost Index of Equipment Operations (Fuels & Lubricants)</td><td>The average whole sale price index for fuel, power, light & Lubricants as notified by Reserve Bank of India for India. The base date shall be date thirty (30) days prior to bid closing date</td></tr>
</table>
</td></tr>
<tr><td>Mobilization Advance</td><td>14.2</td><td>The Mobilization Advance will be given to the Contractor as per the bank rate of interest.</td></tr>
<tr><td>Number and timings of Installments</td><td>14.2</td><td>Three (3) with in 120 days from the date of signing of contract.</td></tr>
<tr><td>Currencies and proportion</td><td>14.2</td><td>Local Currency: Indian Rupee (INR)</td></tr>
</table>

Start repayment of advance payment	14.2	Advance payment shall be repaid through Not less than 15% deductions in each interim payment certificate, all amount to be recovered within 8 months of giving advance. • Entire amount to be recovered by the time, 80% of construction work is completed or stipulated period of construction work whichever is early
Percentage of retention	14.3.1 (c)	7.5% (five percent) of the amount of all Interim Payment Certificates for the Works Contract portion of the Contract, excluding any Provisional Sums (if any)
Limit of Retention Money	14.3.1 (c)	7.5% (five percent) of the Works Contract Price, excluding any Provisional Sums (if any)
Release of Retention Money	14.3.1 (c)	5% of the retention money will be released after the construction period and 2.5 % of retention money will be released after the defect liability period.
Plant and Materials for Payment when delivered to site	14.5 (c)	60 % of the amount claimed by the contractor after certified by the Engineer on receipt of Indemnity bond.
Minimum Amount of Interim Payment Certificate	14.6	2.5 % of the Accepted Contract Amount
Interest on delayed payment	14.9	Not Applicable
Currencies of Payment	14.17	The Contractor shall be paid the currencies as specified in the Bid Document
Period of Submission of evidence : (a) Evidence of insurance (b) Relevant policies	 19.1 19.1	 30 days 30 days
Minimum Amount of Third Party Insurance		Rs 1,000,000/- per occurrence with number of occurrences unlimited. The Insurance should be valid during period of the contract including extension of contract
Limit of the Compensation for delays or interruptions caused by the Contractor	22.5	10 % of Contract Price

Delays and Penalty

1. Plant of Equipment

Contractor shall need to maintain minimum equipment as specified in Clause No . Non-compliance shall result in penalties as below:

Sr.No.	Equipment Type and Characteristics	Minimum Number Required	Deductible per month if not mobilized/ not found in working
1	Excavator	2 No.	50000
2	Concrete weigh batchers	2 No.	50000
3	Concrete Pumps	2 No.	50000
4	Needle/ plate vibrator	6 No.	15000
5	Tippers	4 No.	30000
6	Total station survey equipment set	2 No.	10000
7	Water tanker (with sprinkling arrangements)	2 No.	5000
8	Tower Crane of suitable capacity	1 No.	10000
9	General tor of suitable capacity	1 No.	10000
10	Laboratory apparatus & equipment as per MoRT&H Standard.	1 Set	50000
11	Welding Units	2 Nos.	10000
12	Electrical Testing Kit (Megger, Voltmeter etc. of Various ranges)	1 No.	10000
13	Safety Equipment for personnel	As Required	25000
14	Dewatering Pumps 5 &10 HP	4 each	5000

2. Staff

Non providing the Key-Personnel expert resources as per Section 6 : Employers Requirement shall result into penalty as per following Table. The total penalty shall not exceed 10% of contract value.

No.	Position	Deductible per month if not mobilized (in INR)
1	Project Manager – 1 B. E. Civil	100000
2	Material / Quality Engineer – 1; B.E	75000
3	Installation Engineer – 1; B.E (Mech./Elect./Electronics) (Having experience in car parking systems)	50000
4	Supervisors – 2; Diploma (Mech./Elect./Electronics/Civil)	30000
5	Technicians (ITI) Trained – 2 Nos.	25000
6	Operators (ITI) Trained – 3 Nos. (For Day shifts)	25000

No.	Position	Deductible per month if not mobilized (in INR)
7	Operators (ITI) Trained – 2 Nos. (For Night shift)	25000

3. Delay in Progress of Work

SIP shall be submitted as per the SIP activity schedule. Any delay in submissions will attract penalty specified therein.

Maximum amount of 10 % Contract Price of Liquidated damages to be recovered from Contractor for not completing the Works and Services or any part thereof within the Time for Completion or any extension thereof shall be Liquidated damages for delay of overall contract completion are 0.05% per day. The maximum amount of liquidated damages for such delay is 10% of the Contract Price.

4. As Built Drawings

The as-built drawings will be submitted 14 days after the completion of the respective works.

Contractor shall be levied a penalty of 0.5% of the value of the works for which the as-built drawing has not been submitted.

Schedules to Section 9: Particular Conditions of Contract

Schedule 1: Obligations of the Employer – supplement to GCC Clause 2

Schedule 2: Obligations of the Contractor – supplement to GCC Clause 4

Schedule 3: EMPLOYER Personnel – supplement to GCC Sub-Clause 2.3

Schedule 4: Contractor Payments – supplement to GCC Clause 14

Schedule 5: Performance Targets and Measurement

Schedule 1: Obligations of the Employer

During the term of this Contract, the Employer shall have the following obligations:

1. Overall Project Management including review, finalization and supervision of the Design-Build activities, disbursement of the capital expenditures in accordance with the procedure specified in the construction contract, disbursement of Contractor Payments set out in Schedule 6, taking decisions regarding the completion of the Mandatory Works and the achievement of the respective obligations by each party, and the issue of the certificate of commencement of Design-Build Period and Operating Period.

2. Manage the project roles and responsibilities, interfaces and resolution of problems arising out of them using appropriate level(s) of interface.

3. Employer will be responsible for getting the utility shifting and provide hindrance free right of way to the Contractor. Contractor will provide full support and assistance in identifying utilities and hindrances.

4. Employer shall provide right of access.

5. Be responsible for the overall project management including decisions regarding achievement/non-achievement of Contractor's obligations during Design-Build period and release of eligible payments to the Contractor during this period.

6. Supervise payments to the Contractor, his consultants, vendors and sub-contractors on request of the main Contractor.

7. Manage the project roles and responsibilities, interfaces and resolution of problems arising out of them using appropriate level(s) of interface.

8. Manage and disburse the investment component of the Project.

9. Timely disbursement of all the eligible Contractor Payments on successful fulfilment of Contractor Obligations during Design-Build Period.

Schedule 2: Obligations of Contractor

1. Contractor Obligations

1.1. General Obligations of the Contractor

1.1.1. The Contractor shall have the right and obligation to provide the Construction and Operation Services in the works site on an exclusive basis during the Contract period. Should the Employer desire to expand the Service Area, the Employer and the Contractor shall meet and negotiate in good faith with a view to agreeing on the provision of Operation Service by the Contractor to such expanded Service Area and the payment to the Contractor there for.

1.1.2. The Contractor shall perform the construction and operations in accordance with governing Laws (including all environmental legislations), and procedures, guidelines and agreements with Government of India and Government of AP on GVSCCL, approved SIP, prudent industry practice, the Performance Standards, the urban poor services policies, and the locally applicable regulatory social policies if any.

1.1.3. The Contractor shall have care and custody of Works and Site during the term of this Contract.

1.1.4. Subject to Section 1.1.2 above, the Contractor shall have discretion in determining the means and methods to be used to perform the Construction and Operation Services.

1.2. Accounting, Audit

1.2.1. The Contractor shall maintain accurate and systematic accounts and records in respect of the Operation Service in such form and detail enabling clear identification of all relevant charges and cost incurred by the Contractor and the basis thereof as well as proper and timely technical and financial audits. Such accounts may be audited by external auditors as appointed by Employer.

1.2.2. Financial accounts shall be in accordance with the accepted Indian accounting principles.

1.2.3. The Contractor shall permit the Employer or its designated representative to semi-annually inspect such accounts and records and shall permit appointed Authority to carry out technical and financial audits on an annual basis.

1.3. Conflict of Interests

1.3.1. Neither the Contractor nor its sub-contractors nor the Contractor personnel shall engage during the term of this Contract, either directly or indirectly in any business or professional activities in the Service Area which would conflict with the activities assigned to them under this Contract.

1.3.2. Notwithstanding Sections 1.3.1, the Contractor will be eligible to bid for subsequent contracts related to the Operation Services, but shall not have any right of first refusal.

2. Standard of Construction and Operation Services Provided by the Contractor

2.1. The Contractor shall perform all the Construction and Operation Service from the Commencement Date until the Contract Completion Date in accordance with Section 7 Employer Requirements, Schedule 4

to the Particular Conditions of Contract - Contractor Payments and Schedule 5 to the Particular Conditions of Contract – Performance Targets and Measurements; as well as:

a) The standards of a reasonable and prudent Contractor;

b) All relevant permits set forth in GCC Sub-Clause 2.2 and other permits for services in force from time to time and;

c) All governing Laws, in force from time to time.

2.2. The Contractor shall collect the revenue generated from Operation Service and deposit in the Designated Revenue Account (Escrow Account) maintained by the Employer as described under Section 6, Employer's Requirement.

Schedule 3: GVSCCL Personnel

1. GVSCCL personnel will assist and provide full support to the Contractor in making assessment of existing infrastructure during preparation of Service Improvement Plan and during execution of Construction and Operation Service.

2. GVSCCL shall not depute any personnel for Operation Service of the works.

3. Contractor will arrange all required personnel for Operation Service during the Operation Service period.

4. However if GVSCCL is able to provide some of the existing staff and Contractor wishes to use their services in Operation Service, he/ they can be provided to the Contractor on deputation basis. In such case, Contractor will make all payment related to his salary and allowances and an additional 20% of salary and allowances to the Employer to take care of his/their pension and retirement benefits.

Schedule 4: Contractor Payment

1. The total Contractor Payments comprises of two components:

a. Payment for Design and Construction including operation maintenance during defect liability period; and
b. Payments for Operation and Maintenance Services.

2. Payments for Construction: The eligibility of payment shall be as follows:

Contractor shall be eligible to the payment as Percentage Payment on quoted lump sum offer under the head of A - Payment for Design and Construction including operation maintenance during defect liability period **(Project Cost)**

Price Schedule No. 1 - Plant and Equipment Supplied from Abroad
In respect of plant and equipment supplied from abroad, the following payments shall be made:

Sixty percent (60%) of the total or pro rata CIF or amount upon Incoterm "CIF," upon delivery to Site within 45 days after receipt of invoice. Thirty percent (30%) of the total or pro rata CIF or amount upon issue of the Completion Certificate, within 45 days after receipt of IPC.

Ten percent (10%) of the total or pro rata CIF or amount upon issue of the Operational Acceptance Certificate, within 45 days after receipt of IPC.

Price Schedule No. 2 - Plant and Equipment Supplied from within the Employer's Country
In respect of plant and equipment supplied from within the Employer's country, the following payments shall be made:

EXW price shall include the factory price, freight charges, all applicable taxes.

Sixty percent (60%) of the total or pro rata EXW amount upon Incoterm "Ex-Works," upon delivery to the site within 45 days after receipt of IPC.

Thirty percent (30%) of the total or pro rata EXW amount upon issue of the Completion Certificate, within 45 days after receipt of IPC.

Ten percent (10%) of the total or pro rata EXW amount upon issue of the Operational Acceptance Certificate, within 45 days after receipt of IPC.

Price Schedule No. 3 - Installation and other Services
In respect of installation services for both the foreign and local currency portions, the following payments shall be made:

Eighty percent (80%) of the measured value of work performed by the Contractor, as identified in the said Program of Performance, during the preceding month, as evidenced by the Employer's authorization of the Contractor's application, will be made monthly within 45 days after receipt of IPC.

Ten percent (10%) of the total or pro rata value of installation services performed by the Contractor as evidenced by the Employer's authorization of the Contractor's monthly applications, upon issue of the Completion Certificate, within 45 days after receipt of IPC.

Ten percent (10%) of the total or pro rata value of installation services performed by the Contractor as evidenced by the Employer's authorization of the Contractor's monthly applications, upon issue of the Operational Acceptance Certificate, within 45 days after receipt of IPC.

Price Schedule No. 4 - Design Services
In respect of design services for both the foreign currency and the local currency portions, the following payments shall be made:

Seventy percent (50%) of the total design services amount on submission of design and drawings to employer.

Thirty percent (50%) of the total or pro rata design services amount upon acceptance of design and drawings by Employer within 45 days after receipt of IPC.

Price Schedule No. 5 - Civil Works

(a) For Item No. 1:

i. For Foundation Works of the entire area where puzzle parking systems are proposed, 70% of the quoted price after completion of all Foundation Works.
ii. For finishing works, 10% of the quoted price after completion of all finishing items of Building work including related Sanitary & Plumbing Works.
iii. For Exterior Finishing Works, 10% of the quoted price after completion of all exterior finishing items of Building work.
iv. Final 10 percent after commissioning.

(b) For Item Nos. 2, 3 ,4 :

i. 90% of the quoted price of each item, after completion of each item.
ii. 10% of the quoted price of each item, on commissioning of the complete system.

(c) For Item No. 5 :

For this item, 100% of the quoted price shall be paid after completion of this item.

Price Schedule No.: 7 Operation & Maintenance Services

The contractor liable for complete operation and maintenance of developed facility on payment of quoted premium paid to GVSCCL at the beginning of the year.

Adjustment for changes in costs for Construction:
As per AP E-procurement GO 94.