

GANGTOK SMART CITY DEVELOPMENT LIMITED

REQUEST FOR PROPOSAL (RFP)

Design Built Transfer

NAME OF THE WORK: CONSTRUCTION OF CULTURAL AND CONVENTION CENTRE AT GANGTOK, SIKKIM INCLUDING DEFECT LIABILITY PERIOD OF ONE YEAR

One-Stage, Two-Envelope

Issued on : 14.02.2019

Invitation for Bids No. : 10/SPV/GSCDL/2018 Dt: 14.02.2019

RFP No. : GSCDL/Tender/NIT/CC/2019

Employer : GSCDL, Sokaythang, Gangtok



GANGTOK SMART CITY DEVELOPMENT LIMITED

SOKAYTHANG, GANGTOK

SIKKIM – 737102

CIN – U9309090WB2017SGC223807

Ref No. : 10/GSCDL/Tender/NIT/CC/2019

Date: 14.02.2019

NOTICE INVITING TENDER (NIT) NO: GSCDL/TENDER/NIT/CC/2019

Competitive Bidding (Manual Bidding)

For and on behalf of Gangtok Smart City Development Limited, Chief Executive Officer, invites sealed tender under one envelope two bid system (1E2B) from the eligible contractors/ construction firm enlisted with the Government under DESIGN BUILT TRANSFER mode.

Sl. No.	Contract Package No.	Title of work	Estimated cost (in INR)	Bid security (In INR)	Period of completion	Cost of Bid Document (In INR)
1	2	3	4	5	6	7
1		CONSTRUCTION OF CULTURAL AND CONVENTION, GANGTOK, SIKKIM	2370.50 lakhs	59.26 Lakhs	30 months	2,00,000.00

Instructions to Bidders

1. For complete eligibility and qualification requirement, criteria in the Bidding document as specified should be followed. Financial instruments: Bid Security will be deposited in separate envelope mentioning the amount and the name of Bank either in the form of Bank Guarantee or Bank Draft payable at chief Executive Officer, GSCDL, Gangtok in the main envelope. Offers for partial bids will not be considered and summarily rejected as non-responsive. Summary of criteria are below vide complete instructions/ bidding process/ submission shall be available to the intended bidders on the bidding documents.
2. Interested eligible bidders may go through the bidding documents and obtain further information if any needed, from the Office of the undersigned as stipulated in bidding documents (RFP) issued for this project.
3. A complete set of bidding documents in the ENGLISH language, may be purchased by the interested eligible bidders on submission of bidder application to Chief Executive Officer, GSCDL, Gangtok 737102, Sikkim (India) and on payment of the non-refundable cost of bidding document as specified in Column no. 7 of above during normal office hours and all working days from Date-...26.02.2019, 11.00. hrs to Date-.....27.02.2019, ... 14.00. hrs.
4. A Pre-bid meeting will be held on Date-...20.02.2019. at 13.00 hrs in the Office of the undersigned to clarify the issues and queries raised on the proposed bid. Bidders may seek clarification form the Office of the undersigned on the bid on or before 13.00 hrs of Date-20.02.2019., if required.
5. Sealed bid in duplicate duly signed by authorised signatory must be delivered to CEO, GSCDL, Gangtok 737102, Sikkim (India) on or before ...13.00. hrs of Date-...03.03.2019 .All bids must be accompanied by a Bid Security as specified in the bidding document for an amount as specified above in Column no. 5. Late bid will not be accepted by tendering authority. Technical bid will be opened at ...14.00. hrs on Date-...03.03.2019 by tendering authority for GSCDL in the presence of bidders or bidders' representatives who chose to attend the process. Successful technical bidders will be informed for attending opening of the Financial bidding at the Office of the undersigned at said time and date of the intimation on the notice board of GSCDL, Sokaythang. The details of bids can also be viewed through the website of www.gmcsikkim.in and www.smartnet.niua.org
6. The purchaser/ intending bidders will be responsible for all costs/ expenses incurred in connection with the preparation or delivery of the bids and site visits.
7. GSCDL reserves the right to change or postpone above schedule, reduce the scope of work and reject any non-responsive tenders/ bids without assigning any reason thereof.

Chief Executive Officer
Gangtok Smart City Development Limited

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Section 1 - INSTRUCTIONS TO BIDDERS

GENERAL

1. SCOPE OF BIDS:

In connection with the Invitation for Bids indicated in the Bid Data Sheet (BDS), the Employer/GSCDL, as indicated in the BDS, issues this Bidding Document for the procurement of Works as specified in Section 6 (Employer's Requirements). The name and identification, number of the contract of the Request for Proposal (RFP) are provided in the BDS.

Throughout this Bidding Document:

the term "in writing" means communicated in written form (example by mail, or hand) and delivered against receipt;

except where the context requires otherwise, words indicating the singular also include the plural and words indicating the plural also include the singular; and "day" means calendar day.

1. SOURCE OF FUND:

1.1. The Borrower or Recipient (hereinafter called "GSCDL") indicated in the BDS has applied for or received financing (hereinafter called "funds") from the Smart City Mission (SCM) towards the cost of the project named in the BDS. The Borrower intends to apply a portion of the funds to eligible payments under the contract(s) for which this Bidding Document is issued.

1.2. Deleted

2. Fraud and Corruption

2.1. The Anticorruption Policy applicable in state of Sikkim requires bidders, suppliers, subcontractors and contractors under GSCDL-financed contracts, observe the highest standard of ethics during the procurement and execution of such contracts. In pursuance of this policy, GSCDL.

defines, for the purposes of this provision, the terms set forth below as follows:

- i. "Corrupt practice" means the offering, giving, receiving, or soliciting, directly or indirectly, anything of value to influence improperly the actions of another party;
- ii. "fraudulent practice" means any act or omission, including a misrepresentation, that knowingly or recklessly misleads, or attempts to mislead, a party to obtain a financial or other benefit or to avoid an obligation;
- iii. "Coercive practice" means impairing or harming or threatening to harm, directly or indirectly, any party or the property of the party to influence improperly the actions of a party;
- iv. "collusive practice" means an arrangement between two or more parties designed to achieve an improper purpose, including, influencing improperly the actions of another party;

will reject a proposal for award if it determines that the bidder recommended for award has, directly or through an agent, engaged in corrupt, fraudulent, collusive, or coercive practices in competing for the Contract; will sanction a firm or an individual, at any time, in accordance with the Anti-Corruption Policy and integrity Principles and guidelines(both as amended from time to time),including declaring in-eligible, either

indefinitely or a stated period of time, to participate in GSCDL financed or GSCDL administered activities or to benefit from an GSCDL-finance or GSCDL-administered contract ,financially or otherwise, if it at any time determines that the firm or individual has, directly or through an agent, engaged in corrupt fraudulent, collusive or coercive or other prohibited practices.

Will have the right to require that a provision be included in Bidding Documents and in contracts financed by GSCDL, requiring bidders, suppliers and contractors and consultants to permit the GSCDL to inspect their accounts and records and other documents relating to the Bid Submission and Contract Performance and to have them audited by auditors appointed by GSCDL.

Will cancel the portion of the financing allotted to contract if it determines at any time that representatives of the contractor or of a beneficiary or GSCDL financing engaged in corrupt, fraudulent, collusive or coercive or other prohibited practice during the procurement or the execution of the contract, without the borrower having taken timely and appropriate actions satisfactory to GSCDL to remedy the situation

2.2. Furthermore, Bidders shall be aware of the provisions of GCC 22.2 and 56.2 (h).

3. Eligible Bidders

3.1. A Bidder may be a natural person, private entity, government-owned entity—subject to ITB 4.5—or any combination of them in the form of a Joint Venture (JV) under an existing agreement or with the intent to constitute a legally-enforceable joint venture, coming together to implement the Project. In the case of a JV:

- a. The word Bidder, wherever applicable, shall include all the members of the Joint Venture. In that case, all the references to the Bidder in this document must construe to the reference to all the members of the Joint Venture also.
- b. All partners shall be jointly and severally liable for the execution of the Contract in accordance with the Contract terms, and
- c. The JV shall nominate a representative who shall have the authority to conduct all business for and on behalf of any and all the parties.
- d. of the JV during the bidding process and, in the event the JV is awarded the Contract, during contract execution.
- e. The Maximum number of JV members eligible is specified **in the BDS**.

3.2. A Bidder, and all parties constituting the Bidder, shall have the Indian nationality. A Bidder shall be deemed to have the nationality of a country if the Bidder is a citizen or is constituted, or incorporated, and operates in conformity with the provisions of the laws of that country. This criterion shall also apply to the determination of the nationality of proposed subcontractors or suppliers for any part of the Contract including related services.

3.3. GSCDL considers a conflict of interest to be a situation in which a party has interests that could improperly influence that party's performance of official duties or responsibilities, contractual obligations, or compliance with applicable laws and regulations, and that such conflict of

PART I: BIDDING PROCEDURES

interest may contribute to or constitute a prohibited practice under GSCDL's Anticorruption Policy. In pursuance of GSCDL's Anticorruption Policy's requirement that bidders, suppliers, subcontractors and contractors under GSCDL-financed contracts, observe the highest standard of ethics, GSCDL will take appropriate actions, which include not financing of the contract, if it determines that a conflict of interest has flawed the integrity of any procurement process. Consequently, all Bidders found to have a conflict of interest shall be disqualified. A Bidder may be considered to be in a conflict of interest with one or more parties in this bidding process if, including but not limited to:

- a. they have controlling shareholders in common; or
- b. they receive or have received any direct or indirect subsidy from any of them; or
- c. they have the same legal representative for purposes of this bid; or
- d. they have a relationship with each other, directly or through common third parties, that puts them in a position to have access to information about or influence on the Bid of another Bidder, or influence the decisions of the Employer regarding this bidding process; or
- e. A Bidder participates in more than one bid in this bidding process. Participation by a Bidder in more than one Bid will result in the disqualification of all Bids in which the party is involved. However, this does not limit the inclusion of the same subcontractor in more than one bid; not otherwise participating as a Bidder.
- f. A Bidder or any of its affiliates participated as a consultant in the preparation of the design or technical specifications of the contract that is the subject of the Bid; or
- g. A Bidder or any of its affiliates has been hired (or is proposed to be hired) by the Employer as Engineer for the contract.

3.4. A firm that is under a declaration of ineligibility by the GSCDL in accordance with ITB 3, at the date of the deadline for bid submission or thereafter, shall be disqualified. A bid from a sanctioned or cross debarred firm by any government agencies of Employers country will be rejected. It is the duty of the Contractor/Bidder to notify Employer if the Contractor/Bidder is being debarred by any agencies as mentioned above. The contractor bid will be summarily terminated even after contract has been awarded if it is found to in case of any such information comes to the notice of Employer in such an event the contractor will be liable for all losses and liabilities of Employers as well as of contractors firm.

3.5. Government-owned enterprises in the Employer's country shall be eligible only if they can establish that they are legally and financially autonomous and operate under commercial law, and that they are not a dependent agency of the Employer.

3.6. Bidders shall provide such evidence of their continued eligibility satisfactory to the Employer, as the Employer shall reasonably request.

3.7. In case a prequalification process has been conducted prior to the bidding process, this bidding is open only for prequalified bidders.

4. Eligible Materials, Equipment and Services

- 4.1. The materials, equipment and services to be supplied under the Contract shall have their origin in eligible source countries as defined in ITB 4.2 above and all expenditures under the Contract will be limited to such materials, equipment, and services. At the Employer's request, Bidders may be required to provide evidence of the origin of materials, equipment and services.
- 4.2. For purposes of ITB 5.1 above, "origin" means the place where the materials and equipment are mined, grown, produced or manufactured, and from which the services are provided. Materials and equipment are produced when, through manufacturing, processing, or substantial or major assembling of components, a commercially recognized product results that differs substantially in its basic characteristics or in purpose or utility from its components.

Contents of Bidding Documents

5. Sections of Bidding Document

- 5.1. The Bidding Document consist of Parts I, II, and III, which include all the Sections indicated below, and should be read in conjunction with any Addenda issued in accordance with ITB 8.

PART I Bidding Procedures

- Section 1 - Instructions to Bidders (ITB)
- Section 2 - Bid Data Sheet (BDS)
- Section 3 - Evaluation and Qualification Criteria (EQC)
- Section 4 - Bidding Forms (BDF)
- Section 5 –Bill of Quantities (BOQ)

PART II Employer's Requirements

- Section 6 –Work Requirements (WRQ)

PART III Conditions of Contract and Contract Forms

- Section 7 - General Conditions (GCC)
- Section 8 - Particular Conditions (PCC)
- Section 9 - Contract Forms (COF)

- 5.2. The Invitation for Bids issued by the Employer is not part of the Bidding Document.
- 5.3. The Employer is not responsible for the completeness of the Bidding Document and their Addenda, if they were not obtained directly from the source stated by the Employer in the Invitation for Bids.
- 5.4. The Bidder is expected to examine all instructions, forms, terms, and specifications in the Bidding Document. Failure to furnish all information or documentation required by the Bidding Document may result in the rejection of the bid.

6. Clarification of Bidding Document, Site Visit, Pre-Bid Meeting:

- 6.1. A prospective Bidder requiring any clarification of the Bidding Document shall contact the Employer in writing at the Employer's address indicated in the BDS or raise his 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 given in the BDS. The Employer shall forward copies of its response to all Bidders who have acquired the Bidding Document, including a description of the inquiry but without identifying its source. Should the Employer

deem it necessary to amend the Bidding Document as a result of a request for clarification, it shall do so following the procedure under ITB 8 and ITB 22.2.

- 6.2. The Bidder is encouraged to visit and examine the Site of Works and its surroundings and obtain for itself on its own risk and responsibility all information that may be necessary for preparing the bid and entering into a contract for construction of the Works. The costs of visiting the Site shall be at the Bidder's own expense.
- 6.3. 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.
- 6.4. The Bidder's designated representative is invited to attend a pre-bid meeting, if provided for in the BDS. The purpose of the meeting will be to clarify issues and to answer questions on any matter that may be raised at that stage.
- 6.5. The Bidder is requested, as far as possible, to submit any questions in writing, to reach the Employer not later than three days before the meeting.
- 6.6. Minutes of the pre-bid meeting, including the text of the questions raised, 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. 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.
- 6.7. Nonattendance at the pre-bid meeting will not be a cause for disqualification of a Bidder.

7 A Sufficiency of the Bid: The bidder shall be deemed to have satisfied himself before bidding as to the correctness and sufficiency of his tender for the Scope of Work.

7. Amendment of Bidding Document

- 7.1. At any time prior to the deadline for submission of bids, the Employer may amend the Bidding Document by issuing addenda.
- 7.2. Any addendum issued shall be part of the Bidding Document and shall be communicated in writing to all who have obtained the Bidding Document.
- 7.3. 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.

Preparation of Bids

8. Cost of Bidding

- 8.1. 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.

9. Language of Bid

- 9.1. The Bid, as well as all correspondence and documents relating to the bid exchanged by the Bidder and the Employer, shall be written in English. 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 English, in which case, for purposes of interpretation of the Bid, such translation shall govern.

10. Documents Comprising the Bid

10.1. The Bid shall comprise two envelopes submitted simultaneously, one called the Technical Bid containing the documents listed in ITB 11.2 and the other the Price Bid containing the documents listed in ITB 11.3, both envelopes enclosed together in an outer single envelope.

10.2. The Technical Bid shall comprise the following:

- I. Letter of Technical Bid;
- II. Bid Security, in accordance with ITB 19;
- III. written confirmation authorizing the signatory of the Bid to commit the Bidder, in accordance with ITB 20.2;
- IV. documentary evidence in accordance with ITB 17 establishing the Bidder's qualifications to perform the contract;
- V. Technical Proposal in accordance with ITB 16;
- VI. Any other document required in the BDS.

11.3 The Price Bid shall comprise the following.

- (a) Letter of Price Bid;
- (b) completed Price Schedules, in accordance with ITB 12 and 14, or as stipulated in the BDS;
- (c) Any other document required in the BDS.

10.3. 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 the partners. Alternatively, a letter of Intent to execute a Joint Venture Agreement in the event of a successful bid shall be signed by all partners and submitted with the bid, together with a copy of the proposed agreement

11. Letters of Bid, and Schedules

11.1. The Letters of Technical bid and Price bid, and all documents listed under Clause 11, i.e. Schedules, including the Bill of Quantities etc., shall be prepared using the relevant forms furnished in Section 4 (Bidding Forms) if so provided. The forms must be completed without any alterations to the text, and no substitutes shall be accepted. All blank spaces shall be filled in with the information requested.

12. Alternative Bids: No Alternative bids shall be considered. Bidders submitting unsolicited alternative proposals shall be summarily rejected

13. Bid Prices and Discounts

13.1. The prices and discounts quoted by the Bidder in the Letter of Price Bid and in the Bill of Quantities shall conform to the requirements specified below.

13.2. The Bidder shall submit a bid for whole of the works described in ITB 1.1 by filling in prices for all items of Works, as identified in Section 4 (Bidding forms). In case of admeasurements 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.

13.3. The price to be quoted in the Letter of Price Bid, in accordance with ITB 12.1 shall be the total price of the Bid, excluding any discounts offered.

PART I: BIDDING PROCEDURES

- 13.4. The Bidder shall quote Unconditional discounts, if any, and the methodology for their application in the Letter of Price Bid, in accordance with ITB 14.1.
- 13.5. If so indicated in ITB 1.1, bids are invited for individual contracts or for any combination of contracts (packages), Bidders wishing to offer any price reduction 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. Price reductions or discounts shall be submitted in accordance with ITB 14.4, provided the bids for all contracts are submitted and opened at the same time.
- 13.6. Unless otherwise provided in the BDS and the Conditions of Contract, the 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 4 (Bidding Forms) and the Employer may require the Bidder to justify its proposed indices and weightings.
- 13.7. 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.
- 13.8. Taxes, charges, Cess etc. including (but not limited to) Work Contract Tax (WCT), Seignorage/ Royalty / Labour Cess and any other charges as may be applicable from time to time at the prevailing rates shall be deducted from all payments made to the Contractor. Contractor shall provide E-Way Bills, Form "38", or any other forms and comply with all the formalities that may be required by the Central/State Government for procurement of Owner supplied material.

14. Currencies of Bid and Payment

- 14.1. The currency(is) of the bid and payment shall be as specified in the BDS.

15. Documents Comprising the Technical Proposal

- 15.1. The Bidder shall furnish, as a part of the Technical bid, a Technical Proposal including a statement of work methods, equipment, personnel, schedule and any other information as stipulated in Section 4 (Bidding Forms), in sufficient detail to demonstrate the adequacy of the Bidders' proposal to meet the work requirements and the completion time.

16. Documents Establishing the Qualifications of the Bidder

- 16.1. To establish its qualifications to perform the Contract in accordance with Section 3 (Evaluation and Qualification Criteria) the Bidder shall provide the information requested in the corresponding information sheets included in Section 4 (Bidding Forms).
- 16.2. Domestic Bidders, individually or in joint ventures, applying for eligibility for domestic preference shall supply all information required to satisfy the criteria for eligibility as described in ITB 35.

17. Period of Validity of Bids

- 17.1. Bids shall remain valid for the period specified in the BDS after the bid submission deadline date prescribed by the Employer. A bid valid for a shorter period shall be rejected by the Employer as non-responsive.
- 17.2. 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 a corresponding 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.

18. Bid Security

- 18.1. Unless otherwise specified in the BDS, the Bidder shall furnish as part of its bid, in original form, either Bid Securing Declaration or a Bid Security as specified in the BDS. In case of Bid Security the amount shall be as specified in the BDS.
- 18.2. A Bid Securing Declaration shall use the form included in Section 4 (Bidding Forms).
- 18.3. If a bid security is specified pursuant to ITB 19.1, the bid security shall be, at the Bidder's option, in any of the following forms:
 - (a) an unconditional Bank Guarantee;
 - (b) TDR/ FDR
 - (c) Demand Draft

In the case of a Bank Guarantee, the Bid Security shall be submitted either using the Bid Security Form included in Section 4 (Bidding Forms). The form must include the complete name of the Bidder. The Bid Security shall be valid for twenty-eight days (28) beyond the original validity period of the bid, or beyond any period of extension if requested under ITB 18.2.
- 18.4. Any Bid not accompanied by to substantially compliant Bid Security, if required in accordance with ITB 19.3, or Bid Securing declaration in accordance with ITB 19.2, if required in accordance with ITB 19.1 shall be rejected by the Employer as non- responsive.
- 18.5. 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 furnishing of the Performance Security pursuant to ITB 43.1.
- 18.6. If a Bid Security is specified pursuant to ITB 19.1, 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.
- 18.7. 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, except as provided in ITB 18.2 or
 - (b) if the successful Bidder fails to:
 - i. sign the Contract in accordance with ITB 42;
 - ii. furnish a Performance Security in accordance with ITB 43.1.
 - iii. accept the correction of its Bid price pursuant to ITB 33.2
- 18.8. 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 legally constituted at the time of bidding, Bid Security or the Bid Securing Declaration shall be in the names of all future partners as named in the letter of intent mentioned in ITB 4.1.

19. Format and Signing of Bid

- 19.1. The Bidder shall prepare one original of the documents comprising the bid as described in ITB 11 and clearly mark it "ORIGINAL-TECHNICAL BID AND ORIGINAL-PRICE BID". In addition, the Bidder shall submit copies of the bid, in the number specified in the BDS, and clearly mark each of them "COPY". In the event of any discrepancy between the original and the copies, the original shall prevail.

- 19.2. 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.
- 19.3. Any amendments such as interlineations, erasures, or overwriting shall be valid only if they are signed or initialed by the person signing the Bid.
- 19.4. 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.

Submission and Opening of Bids

20. Sealing and Marking of Bids

- 20.1. Bidders may always submit their bids by mail or by hand. When so specified in the BDS, bidders shall have the option of submitting their bids electronically. Procedures for submission, sealing and marking are as follows.
 - (a) Bidder shall enclose the original of the Technical Bid, the original of the Price Bid, and each copy of the Technical Bid and each copy of the Price Bid, in separate sealed envelopes, duly marking the envelopes as "ORIGINAL - TECHNICAL BID", "ORIGINAL - PRICE BID" and "COPY NO... - TECHNICAL BID" and "COPY NO.... - PRICE BID." These envelopes, the first containing the originals and the others containing copies, shall then be enclosed in one single envelope per set.
 - (b) Bidders submitting bids electronically shall follow the electronic bid submission procedures specified in the BDS.
- 20.2. The inner and outer envelopes shall:
 - (c) bear the name and address of the Bidder;
 - (d) be addressed to the Employer as provided in BDS 22.1;
 - (e) bear the specific identification of this bidding process indicated in the BDS 1.1;
- 20.3. The outer envelopes and the inner envelopes containing the Technical Bid shall bear a warning not to open before the time and date for the opening of Technical Bid, in accordance with ITB Sub-Clause 25.1.
- 20.4. The inner envelopes containing the Price Bid shall bear a warning not to open until advised by the Employer in accordance with ITB Sub-Clause 25.1.
- 20.5. Alternative Bids, if permissible in accordance with ITB Clause 13, shall be prepared, sealed, marked, and delivered in accordance with the provisions of ITB Clauses 20 and 21, with the inner envelopes marked in addition "ALTERNATIVE NO..." as appropriate.
- 20.6. 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.

21. Deadline for Submission of Bids

- 21.1. Bids must be received by the Employer at the address and no later than the date and time indicated in the BDS.
- 21.2. 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.

22. Late Bids

22.1. 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.

23. Withdrawal of Bids

23.1. A Bidder may withdraw, substitute, or modify its Bid – Technical or Price – 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 20.2, (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.

23.2. Bids requested to be withdrawn in accordance with ITB 24.1 shall be returned unopened to the Bidders.

23.3. 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.

24. Bid Opening

24.1. The Employer shall open the Technical bids in public at the address, date and time specified in the BDS in the presence of Bidder’s designated representative and anyone who chose to attend. Any specific electronic bid opening procedures required if electronic bidding is permitted in accordance with ITB 21.1 shall be as specified in the BDS. The Price bids will remain unopened and will be held in the custody of the Employer until the specified time of their opening.

24.2. First, 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.

24.3. Second, outer envelopes marked “SUBSTITUTION” shall be opened. The inner envelopes containing the Substitution Technical Bid and/or Substitution Price Bids shall be exchanged for the corresponding envelopes being substituted, which are to be returned to the Bidder unopened. Only the substitution Technical Bid, if any, shall be opened, read out and recorded. Substitution Price Bid will remain unopened in accordance with ITB Sub-Clause 25.1. No envelope shall be substituted unless the corresponding Substitution Notice contains a valid authorization to request the substitution and is read out and recorded at bid opening.

24.4. Next, outer envelopes marked “MODIFICATION” shall be opened. No Technical Bid and/or Price Bid shall be modified unless the corresponding Modification Notice contains a valid

PART I: BIDDING PROCEDURES

authorization to request the modification and is read out and recorded at the opening of Technical Bids. Only the Technical Bids, both Original as well as Modification is to be opened, read out, and recorded at the opening. Price Bids, both Original and Modification, will remain unopened in accordance with ITB Sub-Clause 25.1.

- 24.5. All other envelopes holding the Technical Bids shall be opened one at a time, and the following read out and recorded:
- (a) the name of the Bidder;
 - (b) Whether there is a modification or substitution
 - (c) the presence of a Bid Security, if required; and
 - (d) any other details as the Employer may consider appropriate.

Only Technical Bids and alternative Technical bids read out and recorded at bid opening shall be considered for evaluation. No Bid shall be rejected at the opening of Technical Bids except for late bids, in accordance with ITB Sub-Clause 23.1.

- 24.6. The Employer shall prepare a record of the opening of Technical Bids that shall include, as a minimum: the name of the Bidder and whether there is withdrawal, substitution or modification, alternative proposals and the presence or absence of a bid security, if one was required. 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.
- 24.7. At the end of the evaluation of the Technical Bids, the Employer will inform the bidders who have submitted substantially responsive Technical Bids and who have been determined as being qualified for award to attend the opening of the Price Bids. The date, time, and location of the opening of Price Bids will be advised in writing by the Employer. Bidders shall be given reasonable notice of the opening of Price Bids.
- 24.8. The Employer will notify Bidders in writing who have been rejected on the grounds of their Technical Bids being substantially non-responsive to the requirements of the Bidding Document and return their Price Bids unopened.
- 24.9. The Employer shall conduct the opening of Price Bids of all Bidders who submitted substantially responsive Technical Bids, in the presence of Bidders' representatives who choose to attend at the address, date and time specified by the Employer. The Bidder's representatives who are present shall be requested to sign a register evidencing their attendance.
- 24.10. All envelopes containing Price Bids shall be opened one at a time and the following read out and recorded:
- (a) the name of the Bidder;
 - (b) Whether there is a modification or substitution,
 - (c) the Bid Prices, including any discounts; and
 - (d) any other details as the Employer may consider appropriate.
- Only Price Bids, discounts, and alternative offers read out and recorded during the opening of Price Bids shall be considered for evaluation. No Bid shall be rejected at the opening of Price Bids.
- 24.11. The Employer shall prepare a record of the opening of Price Bids that shall include, as a minimum: the name of the Bidder, the Bid Price (per lot if applicable), any discounts, and alternative offers. 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.

25. Confidentiality

- 25.1. Information relating to the examination, evaluation, comparison, and post qualification of bids and recommendation of contract award, shall not be disclosed to Bidders or any other persons not officially concerned with such process until information on Contract award is communicated to all Bidders.
- 25.2. Any attempt 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.
- 25.3. Notwithstanding ITB 26.2, from the time of bid opening to the time of Contract award, if any Bidder wishes to contact the Employer on any matter related to the bidding process, it may do so in writing.

26. Clarification of Bids

- 26.1. To assist in the examination, evaluation, and comparison of the Technical and Price bids, and qualification of the Bidders, the Employer may at its discretion ask any Bidder for a clarification of its bid. Any clarification submitted by a Bidder that is not in response to a request by the Employer shall not be considered. The Employer's request for clarification and the response shall be in writing. No change in substance of the Technical bid or prices in the price bid shall be sought, offered, or permitted, except to confirm the correction of arithmetic errors discovered by the Employer in the evaluation of the bids, in accordance with ITB 33.
- 26.2. 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.

27. Deviations, Reservations, and Omissions

- 27.1. 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.

28. Preliminary Examination of Technical Bids

- 28.1. The Employer shall examine the Technical Bid to confirm that all documents and technical documentation requested in ITB Sub-Clause 11.2 have been provided, and to determine the completeness of each document submitted.
- 28.2. The Employer shall confirm that the following documents and information have been provided in the Technical Bid.
 - (a) Letter of Technical Bid
 - (b) Written confirmation of authorization to commit the Bidder
 - (c) Bid Security, if applicable and
 - (d) Technical Proposal in accordance with ITB 16

29. Responsiveness of Technical Bid

- 29.1. The Employer's determination of a bid's responsiveness will be based on the contents of the bid itself, as defined in ITB11.

- 29.2. A substantially responsive Technical 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.
- 29.3. The Employer shall examine the technical aspects of the bid submitted in accordance with ITB 16, Technical Proposal, in particular, to confirm that all requirements of Section 6 (Works Requirements) have been met without any material deviation, reservation or omission.
- 29.4. 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.

30. Nonconformities, Errors, and Omissions

- 30.1. Provided that a bid is substantially responsive, the Employer may waive any nonconformity in the bid that does not constitute a material deviation, reservation or omission.
- 30.2. Provided that a Technical 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 Technical 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.
- 30.3. Provided that a Technical bid is substantially responsive, 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. The adjustment shall be made using the methods indicated in Section 3 (Evaluation and Qualification Criteria).

31. Qualification of the Bidder

- 31.1. The Employer shall determine to its satisfaction during the evaluation of Technical Bids whether Bidders meet the qualifying criteria specified in Section 3 (Evaluation and Qualification Criteria).
- 31.2. The determination shall be based upon an examination of the documentary evidence of the Bidder's qualifications submitted by the Bidder, pursuant to ITB 17.1.
- 31.3. An affirmative determination shall be a prerequisite for the opening and evaluation of a Bidder's Price Bid. A negative determination shall result into the disqualification of the Bid, in which event the Employer shall return the unopened Price Bid to the Bidder.

32- A Subcontractors

- 32-A.1 Unless otherwise stated in the BDS, the Employer does not intend to execute any specific elements of the Works Design and Build by sub-contractors selected in advance by the Employer (so-called "Nominated Subcontractors").
- 32-A.2 The Bidder shall not propose to subcontract the whole of the contract. The Bidder may propose subcontractors for certain specialized parts of the contract. Bidders planning to use such specialized subcontractors shall specify, in the Letter of Bid, the parts of the contract proposed to be subcontracted along with details of the proposed subcontractors including their qualification and experience.
- 32-A.3 Subcontractors proposed by the Bidder shall be fully qualified for their parts of the contract. The subcontractor's qualifications shall not be used by the Bidder to qualify for the contract unless the Bidder designates them as Specialized Subcontractors, in which case, the qualifications of the Specialized Subcontractor proposed by the Bidder may be added to the qualifications of the Bidder for the purpose of the evaluation, if specified in BDS.
- 32-A.4 Bidders may propose subcontracting up to the percentage of total value of contracts or the volume of works as specified in the BDS. Sub-contractors proposed by the Bidder shall be fully qualified for their parts of the Works.

32. Correction of Arithmetical Errors

- 32.1. During the evaluation of Price Bids, the Employer shall correct arithmetical errors on the following basis:
- (a) 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 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.
 - (d) If there is a discrepancy in the ORIGINAL and COPY, the figures given in ORIGINAL shall prevail.
- 32.2. If the Bidder that submitted the lowest evaluated bid does not accept the correction of errors, its Bid shall be disqualified and its bid security may be forfeited.

33. Conversion to Single Currency

- 33.1. For evaluation and comparison purposes, the currency(ies) of the bid shall be converted into a single currency as specified in the BDS.

34. Margin of Preference

- 34.1. Unless otherwise specified in the BDS, a margin of preference shall not apply.

35. Preliminary Examination of Price Bids

Deleted

36. Evaluation of Bids

- 36.1. The Employer shall use the criteria and methodologies listed in this Clause. No other evaluation criteria or methodologies shall be permitted.
- 36.2. To evaluate bid price, the Employer shall consider the following:
- (a) The evaluation committee shall evaluate the Stage-I Qualification Criteria such as preliminary qualifications, financial eligibility and Technical eligibility. The bidder who satisfies these requirements will be made eligible for further evaluation of full technical proposals (Stage-II) on the basis of their responsiveness to the Terms of Reference, applying the evaluation criteria, sub-criteria, and point system specified in **BDS**. Each responsive Proposal will be given a technical score (St). A Proposal shall be rejected at this stage if it does not respond to important aspects of the RFP.
 - (b) The bid price, excluding Provisional Sums and the provision, if any, for contingencies in the Summary Bill of Quantities for admeasurements contracts, or Schedule of Prices for lump sum contracts, but including Day work items, where priced competitively;
 - (c) price adjustment for correction of arithmetic errors in accordance with ITB 33.1;
 - (d) price adjustment due to discounts offered in accordance with ITB 14.4;
 - (e) converting the amount resulting from applying (a) to (c) above, if relevant, to a single currency in accordance with ITB 34;
 - (f) adjustment for nonconformities in accordance with ITB 31.3;
 - (g) The price bid will then be given a financial score as specified in detail in Section 3 (Evaluation and Qualification Criteria);
 - (h) application of all the evaluation factors indicated in Section 3 (Evaluation and Qualification Criteria);
 - (i) Any other additional evaluation factors specified in the BDS and Section 3, Evaluation and Qualification Criteria.
- 36.3. 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.
- 36.4. If this Bidding Document allows Bidders to quote separate prices for different contracts, and to award multiple contracts to a single Bidder, the methodology to determine the lowest evaluated price of the contract combinations, including any discounts offered in the Letter of Bid, is specified in Section 3 (Evaluation and Qualification Criteria).
- 36.5. If the Bid for an admeasurements contract, which results in the lowest Evaluated Bid Price is seriously unbalanced, front loaded or substantially below updated estimates in the opinion of the Employer, the Employer may require the Bidder to produce detailed price analyses for any or all items in the Bill of Quantities, to demonstrate the internal consistency of those prices with the construction methods and schedule proposed. After evaluation of the price analyses, taking into consideration the schedule of estimated Contract payments, the Employer may require that the amount of the Performance Security be increased at the expense of the Bidder to a level sufficient to protect the Employer against financial loss in the event of default of the successful Bidder under the Contract.

37. Comparison of Bids

37.1. The Employer shall compare all substantially responsive bids to determine the lowest evaluated bid in accordance with ITB 37.2.

38. Employer's Right to Accept Any Bid, and to Reject Any or All Bids

38.1. 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.

Award of Contract

39. Award Criteria

39.1. The Employer shall award the Contract to the Bidder whose bid is declared the Most Advantageous Bid by the Tender Evaluation Committee which is substantially responsive to the Bidding Document, provided further that the Bidder is determined to be qualified to perform the Contract satisfactorily.

40. Notification of Award

40.1. Prior to the expiration of the period of bid validity, the Employer shall notify the successful Bidder, in writing, that its bid has been accepted. The Notification letter (hereinafter and in the conditions of contract and contract forms called "The Letter of Acceptance"), shall specify the sum that the Employer will pay the contractor in consideration of the execution and completion of the works. (Hereinafter and in the conditions of contract and contract forms called "The Contract Price").

40.2. Until a formal contract is prepared and executed, the notification of award shall constitute a binding Contract.

40.3. At the same time, the Employer shall put up in the public domain information about the results of the bidding process which will include the following information (i) name of the winning Bidder, and the Price it offered, as well as the duration and summary scope of the contract awarded. After publication of the award, unsuccessful bidders may request in writing to the Employer a debriefing seeking explanations on the grounds on which their bids were not selected. The Employer shall respond in writing to any unsuccessful Bidder who, after publication of contract award, requests a debriefing after the evaluation process is complete.

41. Signing of Contract

41.1. Promptly after notification, the Employer shall send the successful Bidder the Contract Agreement.

41.2. Within fifteen (15) days of receipt of the Contract Agreement, the successful Bidder shall sign, date, and return it to the Employer.

42. Performance Security

42.1. Within fifteen (15) days of the receipt of notification of award from the Employer, the successful Bidder shall furnish the Performance Security in accordance with the Conditions of Contract, subject to ITB 37.5, using for that purpose the Performance Security Form included in Section 9 (Contract Forms), or another form acceptable to the Employer. If the institution issuing the Performance Security is located outside the country of the Employer, it

PART I: BIDDING PROCEDURES

- shall have a correspondent financial institution located in the country of the Employer to make it enforceable.
- 42.2. 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 next lowest evaluated Bidder whose offer is substantially responsive and is determined by the Employer to be qualified to perform the Contract satisfactorily.
- 42.3. The above provision shall apply for furnishing of a domestic preference security if so required.

Section 2 - BID DATA SHEET

This Section Consists of Provisions that are Specific to each procurement and Supplement the information and requirements included in Section 1 – Instructions to Bidders.

A. Introduction

ITB 1.1	The number of the Invitation for Bids is:
ITB 1.1	The Employer is: Gangtok Smart City Development Limited
ITB 1.1	The name of the bidding process is: Request for Proposal (RFP) The name of the RFP is: CONSTRUCTION OF CULTURAL AND CONVENTION CENTRE AT GANGTOK, SIKKIM INCLUDING DEFECT LIABILITY PERIOD OF ONE YEAR Identification no of this bidding process is- GSCDL/Tender/NIT/CC/2019
ITB 2.1	The Borrower is: GSCDL
ITB 2.1	The name of the Project: CONSTRUCTION OF CULTURAL AND CONVENTION CENTRE AT GANGTOK, SIKKIM INCLUDING DEFECT LIABILITY PERIOD OF ONE YEAR
ITB 4.1 (a)	The individuals or firms in a JV is allowed and shall be jointly and severally liable. Maximum number of members in the JV shall be - 3
ITB 4.1(c)	In support of the requirements for the Joint Venture, a Joint Venture Agreement and a Power of Attorney in favour the JV nominated representative should be submitted.

B. Bidding Documents

ITB 7.1	For <u>clarification purposes</u> only, the Employer's address is: Attention: Chief Executive Officer Postal Address: Office of the CEO, GSCDL Office, Sokaythang, Gangtok. ZIP Code: 737102 Country: India Telephone:
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	<p>Facsimile number: -</p> <p>Electronic mail address: gangtoksmartcity@gmail.com</p> <p>Website: www.gmcsikkim.in & www.smartnet.niua.org</p> <p>Requests for clarification should be received by the Employer not later than: 7 days before the closing date of the bid.</p>
ITB 7.4	A Pre-Bid meeting will be held on Date 20.02.2019 at 13:00 hrs at the Employer's Office.

C. Preparation of Bids

ITB 11.2(g)	Bidder shall submit with its Technical Bid the following additional documents: NIL
ITB 11.3(d)	Bidder shall submit with its Price Bid the following additional documents: Rate Analysis of major items
ITB 14	The Bidder shall be deemed to have been satisfied himself as to the correctness and sufficiency of the Bid and the rates and prices stated in the Bill of Quantities, all of which shall, except in so far as it is otherwise provided in the contract, cover all his obligations under the contract and all matters and things necessary for the proper execution and completion of the works and the remedying of any defects there in.
ITB 15.1	The prices shall be quoted by the bidder and shall be paid in: Indian Rupees
ITB 18.1	The bid validity period shall be 120 days after the bid submission deadline date.
ITB 19.1	The Bidder shall furnish a Bid Security for an amount of INR 59.26 Lakhs
ITB 19.3	The Bid Security shall be in the form of an unconditional and irrevocable Bank Guarantee/ TDR/ FDR only from a Nationalized /Scheduled bank in India or State Bank of Sikkim, Gangtok. The validity of Bid Security shall be 28 days beyond the original validity period of 120 days or beyond any of extension if requested.
ITB 20.1	In addition to the original of the bid, the number of copies is: 1 (one)
ITB 20.2	<p>The written confirmation of authorization to sign on behalf of the Bidder shall consist of:</p> <p>(a) Power of Attorney from the authorized person to issue from the company.</p> <p>(b) In the case of Bids submitted by an existing or intended JV, an Joint Venture Agreement signed by all parties:</p>

	<p>(i) _____ tating that all parties shall be jointly and severally liable, and</p> <p>(ii) _____ nominating a Representative who shall have the authority to conduct all business for and on behalf of any and all the parties of the JV during the bidding process and, in the event the JV is awarded the Contract, during contract execution.</p> <p>(c) All the pages of the bid shall be signed or initialed by a person signing the bid along with the seal.</p>
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D. Submission and Opening of Bids

ITB 21.1	Bidder shall not have the option of submitting their bids electronically.
ITB 21.1(a)	The Bidder should use the bid documents in original and duplicate issued to him by the Employer for filling and submitting the price bid along with supporting information, if any. He should prepare and submit the technical bid in the formats given in the bid document and submit it separately.
ITB 21.1(b)	Electronic Bid Submission shall be not applicable.
ITB 22.1	<p>For bid submission purposes only, the Employer's address is:</p> <p>Attention: Chief Executing Officer, GSCDL.</p> <p>Postal Address: Office of the CEO, Sokaythang, Gangtok- 737102, East Sikkim.</p> <p>Floor/Room number:</p> <p>City: Gangtok</p> <p>ZIP Code: 737102</p> <p>Country: India</p> <p>The deadline for bid submission is:</p> <p>Date: 03.03.2019</p> <p>Time: 13:00 Hrs IST</p>
ITB 25.1	<p>The opening of the Technical Bid shall take place at:</p> <p>Office of the CEO, Sokaythang</p> <p>Postal Address: Office of the CEO, Sokaythang, Gangtok- 737102, East Sikkim.</p> <p>Floor/Room number:</p> <p>City: Gangtok</p> <p>Country: India</p>

Date	03.03.2019
Time:	14:00Hrs IST

E. Evaluation and Comparison of Bids

ITB 32-A- 4	<p>(a) Contractor's proposed subcontracting: Maximum percentage of subcontracting permitted is: 25% of the total contract amount.</p> <p>(b) Bidders planning to subcontract more than 10% of total volume of work shall specify, in the Letter of Bid, the activity(ies) or parts of the works to be subcontracted along with complete details of the sub-contractors and their qualification and experience. The qualification and experience of the sub-contractors must meet the minimum criteria for the relevant work to be sub-contracted failing which such subcontractors will not be permitted to participate.</p>
ITB 34.1	The currency that shall be used for bid evaluation and comparison purposes to convert all bid prices expressed in various currencies into a single currency is: INR
ITB 35	A margin of preference shall not apply
ITB 37.2 (h)	<p>Additional requirements apply.</p> <p>These are detailed in the evaluation criteria in Section III, Evaluation and Qualification Criteria.</p>
ITB 43.1	Performance Security shall be from a nationalized bank/scheduled bank situated in India and shall be valid for a period of 28 days beyond the DLP (defects liability period)
ITB 43.3	Not applicable

Section 3 - EVALUATION AND QUALIFICATION CRITERIA

1. Evaluation

In addition to the criteria listed in ITB 37.2 (a) – (i) the following criteria shall apply:

Additional Evaluation Criteria

The technically shortlisted bidders are required to give a presentation on the proposed design which will include 3-D elevation, prospective etc. of the building to be constructed under the contract to the evaluation committee. The presentation on the conceptual elevation will also form part of the evaluation criteria

1.1 Adequacy of Technical Proposal

Evaluation of the Bidder's Technical Proposal will include an assessment of the Bidder's technical capacity to mobilize key equipment and personnel for the contract consistent with its proposal regarding work methods, scheduling, and material sourcing in sufficient detail and fully in accordance with the requirements stipulated in Section 6 (Works Requirements).

1.2 Multiple Contracts- Not Applicable

1.3 Completion Time- Not Applicable

1.4 Alternative Technical Solutions- Not Applicable

1.5 Margin of Preference (Applicable for ICB only:- Not Applicable)

1.6 Quantifiable Nonconformities, Errors and Omissions- Not Applicable

The evaluated cost of quantifiable nonconformities, errors and/or omissions is determined as follows:

"Pursuant to Sub-Clause 31.3 of Section 1: Instructions to Bidders, the cost of all quantifiable non-conformities, errors, or omissions in a Bidder's Bid Proposal shall be evaluated. The Employer shall make its assessment of the cost of any quantifiable nonmaterial non conformities, errors, or omissions for the purpose of ensuring fair comparison of Bids, and for this purpose, the Employer shall base its assessment on the highest price quoted for the same item(s) or component(s) by the other responsive Bidders."

2. Qualification Criteria

Eligibility and Qualification Criteria			Compliance Requirements				Documentation
No.	Subject	Requirement	Single Entity	Joint Venture (existing or intended) where permitted			Submission Requirements
				All members Combined	Each Member	At least one Member	
1. Eligibility							
1.1	Nationality	Nationality in accordance with ITB 4.2	Must meet requirement	Must meet requirement	Must meet requirement	N/A	Forms ELI – 1 and ELI-2, with attachments
1.2	Conflict of Interest	No conflicts of interest in accordance with ITB 4.3	Must meet requirement	Must meet requirement	Must meet requirement	N/A	Letter of Technical Bid
1.3	GSCDL Eligibility	Not having been declared ineligible by the GSCDL & any other agencies in India in accordance with ITB 4.4.	Must meet requirement	Must meet requirement	Must meet requirement	N/A	Letter of Technical Bid
1.3A		Class IAA Contractor registered under unified registration system in SK PWD with a valid UIN or Equivalent Registration in any state Govt. Dept. Central Govt. Dept., other Govt. Dept./undertaking of state /Central Govt.	Must meet requirement	Must meet requirement	Must meet requirement	N/A	Forms ELI – 1 and ELI-2, with attachments
1.4	Government-owned enterprise or	Meets conditions of ITB 4.5.	Must meet requirement	Must meet requirement	Must meet requirement	N/A	Forms ELI – 1 and ELI-2, with

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Eligibility and Qualification Criteria			Compliance Requirements				Documenta tion
N o.	Subje ct	Requirement	Singl e Entit y	Joint Venture (existing or intended)where permitted			Submissio nRequirem ents
				All mem bers Com bine d	Each Mem ber	At least one Mem ber	
	institution		ment	ement t	ement t		attachments
2. 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 <i>1st January 2013</i> .	Must meet requirements ¹ & 2	Must meet requirements	Must meet requirements ²	N/A	Form LIT- 1
2. 2	Pending Litigation	Bidder's financial position and prospective long term profitability sound according to criteria established in 3.1 below and assuming that all pending litigation will be resolved against the Bidder	Must meet requirement by itself or as member to past or existing JV	N/A	Must meet requirement by itself or as member to past or existing JV	N/A	Form LIT- 1
3. Financial Situation and Performance							

¹Nonperformance, as decided by the Employer, shall include all contracts where (a) nonperformance 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. Nonperformance shall not include contracts where Employers decision was overruled by the dispute resolution mechanism. Nonperformance 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.

PART I: BIDDING PROCEDURES

Eligibility and Qualification Criteria			Compliance Requirements				Documenta tion
N o.	Subje ct	Requirement	Singl e Entit y	Joint Venture (existing or intended)where permitted			Submissio nRequirem ents
				All mem bers Com bine d	Each Mem ber	At least one Mem ber	
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 <i>INR 500 Lakhs (Indian Rupees five hundred lakhs)</i> for the subject contract(s) net of the Bidder's other commitments	Must meet requirement	Must meet Requirement	Must meet at least 25% of the requirement as a minimum	Must meet at least 50% of the requirement as a minimum	Form FIN – 3.1, with attachments
		(ii) The Bidders shall also demonstrate, to the satisfaction of the Employer, that it has adequate sources of finance to meet the cash flow requirements on works currently in progress and for future contract commitments.	Must meet requirement	Must meet requirement	N/A	N/A	
		(iii) The audited balance sheets, income statement and Cash flow statement for the last 5 (five) years shall be submitted and must demonstrate the current soundness of the Bidder's financial position and indicate its prospective long-term profitability.	Must meet requirement	N/A	Must meet requirement	N/A	

PART I: BIDDING PROCEDURES

Eligibility and Qualification Criteria			Compliance Requirements				Documenta tion																		
N o.	Subje ct	Requirement	Singl e Entit y	Joint Venture (existing or intended)where permitted			Submissio nRequirem ents																		
				All mem bers Com bine d	Each Mem ber	At least one Mem ber																			
3. 2	Average Annual Construction Turnover	Minimum average annual engineering construction turnover ³ (in at least two of the last 5 (five) financial years) in civil engineering construction work of <i>INR 1000 Lakhs (Indian Rupees one thousand Lakhs)</i> , calculated as total certified payments received for contracts in progress and/or completed within the last 5 (five) years.	Must meet requir emen t	Must meet requir emen t	Must meet 25%, (twe nty five perce nt)of the requir emen t	Must meet 50%, (fifty perce nt)o f the requi reme nt	Form FIN – 3.2																		
<p>The turnover of the previous years' value shall be updated to 2018-19 price level by giving weightage of 7 % per year as follows:</p> <table border="1"> <thead> <tr> <th>S. No</th> <th>Financial Year</th> <th>Weightage</th> </tr> </thead> <tbody> <tr> <td>(i)</td> <td>2017-18</td> <td>1.00</td> </tr> <tr> <td>(ii)</td> <td>2016-17</td> <td>1.07</td> </tr> <tr> <td>(iii)</td> <td>2015-16</td> <td>1.14</td> </tr> <tr> <td>(iv)</td> <td>2014-15</td> <td>1.23</td> </tr> <tr> <td>(v)</td> <td>2013-14</td> <td>1.31</td> </tr> </tbody> </table>								S. No	Financial Year	Weightage	(i)	2017-18	1.00	(ii)	2016-17	1.07	(iii)	2015-16	1.14	(iv)	2014-15	1.23	(v)	2013-14	1.31
S. No	Financial Year	Weightage																							
(i)	2017-18	1.00																							
(ii)	2016-17	1.07																							
(iii)	2015-16	1.14																							
(iv)	2014-15	1.23																							
(v)	2013-14	1.31																							
4. Experience																									

³At financial year 2017-18 price level. Financial turnover of previous years shall be given weightage @5% per year based on Indian Rupees value to bring them to the price level of the financial year in which bids are received.

PART I: BIDDING PROCEDURES

Eligibility and Qualification Criteria			Compliance Requirements				Documentation
N o.	Subje ct	Requirement	Singl e Entit y	Joint Venture (existing or intended)where permitted			Submissio nRequirem ents
				All mem bers Com bine d	Each Mem ber	At least one Mem ber	
4.1	Construction of RCC buildings	<p>A minimum number of 3 (three) contracts of similar nature involving Reinforced cement concrete structure undertaken as lead contractor between <i>1st January 2013</i> and Bid submission deadline.</p> <p>The selected structure should be applicable to residential, commercial and institutional building project that: have been satisfactorily and substantially completed, and each have a minimum value of INR 1000 Lakhs (Indian Rupees one thousand lakhs only)</p>	Must meet requirement	Must meet requirement	N/A	N/A	Form EXP 4.1
4.2	Electrical works	A minimum number of 2 (two) been satisfactorily and substantially ⁴ completed as a prime contractor,	Must meet requirement	Must meet requirement	N/A	N/A	Form EXP – 4.2

⁴ Substantial completion shall be based on 80% or more works completed under the contract.

PART I: BIDDING PROCEDURES

Eligibility and Qualification Criteria			Compliance Requirements			Documenta tion	
N o.	Subje ct	Requirement	Singl e Entit y	Joint Venture (existing or intended)where permitted			Submissio nRequirem ents
				All mem bers Com bine d	Each Mem ber	At least one Mem ber	
		joint venture member, management contractor or subcontractor between 1 st January 2013 and Bid submission deadline. The value of the member's participation in each selected construction contract shall be a minimum of INR 200 Lakhs (Indian Rupees two hundred Lakhs only)	emen t	emen t ⁵			
4.2A	Specific Construction Experience	For contracts successfully completed between 1st January 2013 and bid submission deadline, a minimum construction experience in the following key activities as prime contractor, JV member, management contractor or subcontractor: The bidder should have designed and executed at least 2 buildings conforming to traditional Sikkim architecture including design and execution of convention hall with acoustic system with value of minimum of INR 500.00 Lakhs (Rupees Five hundred lakhs) in last	Must meet requiremen t	Must meet requiremen t	Shoul d meet the criteri a in full, at least for one of key activit ies listed	Must meet requireme nt for the key activi ties listed belo w	Form EXP – 4.2A

⁵In 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.

PART I: BIDDING PROCEDURES

Eligibility and Qualification Criteria			Compliance Requirements			Documenta tion	
N o.	Subje ct	Requirement	Singl e Entit y	Joint Venture (existing or intended)where permitted			Submissio nRequirem ents
				All mem bers Com bine d	Each Mem ber	At least one Mem ber	
		5 years			in colu mn 3.		
4.5 (a)	<p>Bid Capacity:</p> <p>Bidders who meet the minimum qualification criteria will be qualified only if their available bid capacity for construction work is equal to or more than the total bid value of the work. The available bid capacity will be calculated as under:</p> <p>Assessed Available bid capacity = (A*N*1.5-B)</p> <p>Where,</p> <p>A = Maximum value of civil engineering works executed in any one year during the last 5(five) years (updated to the price level of the financial year2017-18 at the rate of 5% per year), taking into account the completed as well as works in progress).</p> <p>N = Number of years prescribed for construction of the works for which bids are invited (period upto 6 months to be taken as half-year and more than 6 months as one year).</p> <p>B = Value, at the current price level, of existing commitments on on-going works to be completed during the period of construction of the works for which bids are invited.</p> <p>Note: the statements in Section IV showing the value of existing commitments of on-going works as well as the stipulated period of completion remaining for each of the works listed should be countersigned by the Engineer in charge, not below the rank of an Executive Engineer or equivalent.</p>						
4.5 (b)	<p>Even though the bidders may meet the above qualifying criteria, they are subject to be disqualified if they have: -</p> <ul style="list-style-type: none"> made misleading or false representations in the forms, statements, affidavits, and attachments submitted in proof of the qualification requirement; record of poor performance such as abandoning the works, not properly completion or financial failures etc. consistent history of litigation or arbitration awards against the bidder or any member or the joint venture. 						

PART I: BIDDING PROCEDURES

Eligibility and Qualification Criteria			Compliance Requirements			Documenta tion	
N o.	Subje ct	Requirement	Singl e Entit y	Joint Venture (existing or intended)where permitted			Submissio nRequirem ents
				All mem bers Com bine d	Each Mem ber	At least one Mem ber	
		Participated in the previous bidding (if this is a re-bidding) for the same work and had quoted unreasonably high bid price and could not furnish any rational justification for the same to the employer.					

General notes for the Bidder:

1. Substantial completion shall be based on 80% or more of the contract completed.
2. For contracts under which the Bidder participated as a joint venture member or sub-contractor, only the Bidder's role and responsibilities shall be considered as qualifying experience.

Personnel

The Bidder must demonstrate that it has the personnel for the key positions that meet the following requirements:

No.	Position	Total Work	Experience
		Experience [years]	In Similar Works [years]
1	Project Manager – 1 no.	B.E./ Diploma in Civil Engineering with 10 years' experience in relevant field	B.E./ Diploma in Civil Engineering with 2 years' experience in relevant field
2	Civil Engineer-1 no.	B.E./ Diploma in Civil Engineering with 5 years' experience in relevant field	B.E./ Diploma in Civil Engineering with 2 years' experience in relevant field
3	Site supervisors-3 no.	Diploma in Civil Engineer with 5 years' experience in relevant field; or B.E. Civil Engineering with 2 years' experience in relevant field	Diploma in Civil Engineer with 2 years' experience in relevant field; or B.E. Civil Engineering with 1 years'

		experience in relevant field
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Note: The bidder shall furnish separate list of key personnel

The Bidder shall provide details of the proposed personnel and their experience records in the relevant Information Forms PER- 1 and PER- 2 included in Section 4 (Bidding Forms).

Equipment

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

No.	Equipment Type and Characteristics	Min. Number Required
1	Reversible Concrete Drum Mixer 21/14	1
2	Vibrator 5 hp / 2hp with nozzles 60 /40/20 / as required	4
3	Crawler excavator Ex- 200/300 or equivalent	2
4	Plywood shuttering for casting of slab/beam/columns etc	1000 sqm
5	Scaffolding for putting up formwork upto height of 4m for slab and external façade and finishing works upto to height of 12 m	1000 sqm
6	Laboratory for testing fineness, consistency, setting time compressive & tensile strength of cement compressive & flexural strength of Cement concrete and proof stress, elongation, tensile strength, bending & re-bending of reinforcement steel. Affidavit for Fully equipped field level laboratory for testing of general materials located at project site or at authority approved nearby place.	1

The Bidder shall provide further details of proposed items of equipment using the relevant Form EQ-1 and EQ- 2 in Section 4 (Bidding Forms)

3. Bid Evaluation Process

The method of evaluation of the Most Advantageous Bid will be based on the following steps as given below.

The Employer shall constitute a Tender Evaluation Committee to evaluate the responses of the bidders. The Tender Evaluation Committee shall evaluate the responses to the RFP and all supporting documents/documentary evidence. Inability to submit requisite supporting documents/documentary evidence by bidders may lead to rejection of their bids.

The decision of the Tender Evaluation Committee in the evaluation of bids shall be final. No correspondence will be entertained outside the process of evaluation with the Committee. The Tender Evaluation Committee may ask for meetings or presentation with the Bidders to seek clarifications or conformations on their bids.

The tender Evaluation Committee reserves the right to reject any or all bids. Each of the responses shall be evaluated as per the criteria and requirements specified in this RFP. The steps for evaluation are as follows-

3.1 Stage 1:Pre-Qualification (document sufficiency)

The Technical Evaluation Committee shall validate the following documents as per RFP. Each of the Pre-Qualification condition mentioned in this RFP is MANDATORY. In case, the Bidder does not meet any one of the conditions, the bidder shall be disqualified.

- 3.1.1. Demand Draft towards the cost of bid from a Nationalized/ Scheduled / commercial Bank drawn in favor of CEO, GSCDL, Gangtok 737102, Sikkim.
- 3.1.2. Unconditional BG/ FDR/ TDR/ Demand Draft in respect of Bid Security from any nationalized/Scheduled /commercial Bank drawn in favor of CEO, GSCDL, Gangtok 737102, Sikkim.
- 3.1.3. Permanent Account No (PAN) of the Bidder/Firm/Company/ Society.
- 3.1.4. Self-attested copy of Sales/ Service Tax/ GST registration and Sales/ Service Tax/ GST returns filed in last three years.
- 3.1.5. Self-attested copy of certificate that the up-to date Income Tax Returns filed.
- 3.1.6. Self-attested documentary evidence of (a) the Proof of Residence of the Bidder (in case of Proprietor/Partnership Firm (b) Proof of Registered Office of the Company and Residential Address of the Director/Authorized Representative (in case of Bidder being a Company) (c) Proof of Registered office of the Society and Residence of President/Secretary (in case Bidder being a Society) as well as, Proof of the Address of the Office of the Bidder Firm/Company/Society.
- 3.1.7. Self-attested copy of bank statement indicating name of the Bank and Account No. of the Bidder Firm/Company/Society.
- 3.1.8. The bidders should submit copy of valid Certificate of Registration attested by Company Secretary/ Authorized Signatory
- 3.1.9. Bidding forms ELI- 1, 2 and LIT-1 establishing the eligibility of the bidder to bid the contract along with relevant certificates.
- 3.1.10. Bidding forms EXP 4.1, 4.2, 4.2A establishing the experience of similar works done by the bidder along with completion certificate from the client agency certifying the successful completion of the similar work done by the bidder.
- 3.1.11. Bidding forms FIN- 3.1, 3.2 establishing the financial capacity of the bidder. The turnover/network/financial status of the bidder shall be ascertained from the following documents which the bidder is required to submit along with the tender

document for the preceding five financial years FY 2013-14, 2014-15, 2015-16, 2016-17 and 2017-18 duly certified by a Chartered Accountant

- Audited Financial Statement of the Firm/Company/ Society
- Audited Balance sheet of the Firm / Company /Society
- Audited copies of profit and loss statements
- Audited copies of Cash flow statements

3.1.12. The scanned copy of latest license from Labour Commissioner to employ contract labour under Contract Labour Act may be submitted.

3.1.13. The bidder has to submit a Letter of Bid as per format given.

3.1.14. Technical bids along with the compliance sheet of technical specifications and with necessary documents should be filled in all respects and each paper should be signed by the authorized representative and submitted.

3.1.15. The bidder has to submit financial bid in separate sealed marked as “Financial Bide” on the envelope and should contain Letter of Price Bid, Price Schedules.

3.2 Stage II Technical Evaluation

The Technical Evaluation Committee will review the technical bids of the bidders who have cleared the document sufficiency stage, to determine whether the technical bids are substantially responsive. Bids that are not substantially responsive are liable to be disqualified at Authority’s discretion.

Each bidder will be called to make a presentation of the proposed works in which the following is to be presented

- their understanding of the work and their plan to execute.
- Conceptual elevations and designs of the buildings proposed including the material of construction that will be used
- Conceptual designs of the Landscaping

Each Technical Bid will be assigned a Technical Score out of a maximum of 50 points based on the table given below. This includes the evaluation of the presentation given by the bidder to the evaluation committee.

Section III Clause	Evaluation Criteria	Evaluation Parameter	Points
Bidders Technical Qualification Criteria			
2 sub clause 4.1	Construction of RCC buildings	No. of Projects executed > INR 1000 Lakhs •	5

		5 projects – 100% <ul style="list-style-type: none"> • 3 projects and < 5 – 70% 	
2 sub clause 4.2	Electrical works	Number of projects completed > INR 200 Lakhs <ul style="list-style-type: none"> • 4 projects and above- 100% • 3 projects – 85% • 2 Projects – 70% 	5
2 sub clause 4.2 A	Construction of buildings conforming to traditional Sikkim architecture including design and execution of convention hall with acoustic system	Number of projects completed > INR 200 Lakhs <ul style="list-style-type: none"> • 4 projects and above- 100% • 3 projects – 85% • 2 Projects – 70% 	5
Approach & Methodology and Concept Presentation			
1	Project Presentation	<ul style="list-style-type: none"> • The Bidder understanding of project – 20 points • Presentation of Approach & Methodology – 20 points • Concept design and presentation including prospective etc. for the structures to be built based on Sikkimese traditional Architecture based on existing structures so as to seamlessly get integrated with the existing buildings– 60 points 	35

3.3 Stage III Financial Evaluation

All bidders who have been technically qualified will be notified to participate in Financial Bid opening process. The Financial bids of all the bidders shall then be opened on the notified date and time and reviewed to determine whether the commercial bids are substantially responsive. Bids that are not substantially responsive are liable to be disqualified at Authority's discretion.

Financial bids that are not as per the format provided shall be liable for rejection.

The Lowest price bid received will be assigned 50 marks and the highest will be assigned 10.

PART I: BIDDING PROCEDURES

All other price bids received will be given marks based on the interpolation between Lowest given as 50 and highest given 10.

The marks so obtained from financial evaluation will be added to marks given in the Technical evaluation

The bidder who secures highest marks will be considered as Most Advantageous Bid and the bidder will be awarded the Letter of Award.

Bid Security of all other bidders shall be returned after successful bidder selected by authority..

Section 4 - BIDDING FORMS

LETTER OF TECHNICAL BID

The Bidder must accomplish the Letter of Bid in its letterhead clearly showing the Bidder's complete name and address.

Date:

Bid No.:

Invitation for Bid No.:

To: CEO, GSCDL, Sokaythang, Gangtok.

We, the undersigned, declare that:

- (a) We have examined and have no reservations to the Bidding Documents, including Addenda No. _____;
- (b) We offer to execute in conformity with the Bidding Documents the following Works: **CONSTRUCTION OF CULTURAL AND CONVENTION CENTRE AT GANGTOK, SIKKIM INCLUDING DEFECT LIABILITY PERIOD OF ONE YEAR**
- (c) Our bid shall be valid for a period as specified in the BDS ITB 18.1 (or as amended if applicable) _____ (fill the number of days as per ITB 18.1) from the date fixed for the bid submission deadline in accordance with the Bidding Documents, and it shall remain binding upon us and may be accepted at any time before the expiration of that period;
- (d) If our Bid is accepted, we commit to obtain a Performance Security in the amount of 5 percent of the contract Price for the due performance of Contract.
- (e) Our firm, including any subcontractors or suppliers for any part of the Contract, have Indian nationalities;
- (f) We, hereby certify that we including any subcontractors or suppliers for any part of the contract meet the eligibility criteria and do not have any conflict of interest in accordance with ITB 4 ⁶;

⁶Include if price adjustment provisions apply in the Contract in accordance with PCC Sub-Clause 44.1.

PART I: BIDDING PROCEDURES

- (g) We are not participating, as a Bidder or as a subcontractor, in more than one bid in this bidding process in accordance with ITB 7,
- (h) Our firm, its affiliates or subsidiaries, including any Subcontractors or Suppliers for any part of the contract, has not been declared ineligible by the Employer & other agencies, under the Employer’s country laws;
- (i) 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;
- (j) We understand that this Bid, together with your written acceptance thereof included in your notification of award, shall constitute a binding contract between us, until a formal Contract is prepared & executed.
- (k) We understand that you are not bound to accept the lowest evaluated bid or any other bid that you may receive.
- (l) We agree to permit GSCDL or its representative to inspect our accounts and records and other documents relating to the bid submission and to have them audited by auditors appointed by the GSCDL⁷.

Name

In the capacity of

Signed

Duly authorized to sign the Bid for and on behalf of

Date

⁷Use one of the two options as appropriate.

APPENDIX TO BID- TECHNICAL PART

(Technical Bid Forms)

BID SECURITY

Bank Guarantee

Bank's Name, and Address of Issuing Branch or Office

Beneficiary:

Date:

Bid Security No.:

We have been informed that name of the Bidder. . . . (hereinafter called "the Bidder") has submitted to you its bid dated (Hereinafter called "the Bid") for the execution of name of Contract. under Invitation for Bids No. ("the IFB").

Furthermore, we understand that, according to your conditions, bids must be supported by a bid guarantee.

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

- (a) has withdrawn its Bid during the period of bid validity specified by the Bidder in the Form of Bid; or
(b) does not accept the correction of errors in accordance with the Instructions to Bidders (hereinafter "the ITB"); or
(c) having been notified of the acceptance of its Bid by the Employer during the period of bid validity, (i) fails or refuses to execute the Contract Agreement, or (ii) fails or refuses to furnish the performance security, in accordance with the ITB.

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

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

..... Bank's seal and authorized signature(s)

TECHNICAL PROPOSAL

Form PER – 1: Proposed Personnel

Bidders should provide the names of suitably qualified personnel to meet the specified requirements for each of the positions listed in Section 3 (Evaluation and Qualification Criteria). The data on their experience should be supplied using the Form below for each candidate.

1	Title of position
	Name
2	Title of position*
	Name
3	Title of position*
	Name
4	Title of position*
	Name
5	Title of position*
	Name

*As listed in section 3(Evaluation and Qualification criteria)

PART I: BIDDING PROCEDURES

Form PER – 2: Resume of Proposed Personnel

The Bidder shall provide all the information requested below. Fields with asterisk (*) shall be used for evaluation.

Position*		
Personnel information	Name	Date of birth
	Professional qualifications	
Present employment	Name of employer	
	Address of employer	
	Telephone	Contact (manager / personnel officer)
	Fax	E-mail
	Job title	Years with present employer

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

From *	To*	Company, Project, Position and Relevant Technical and Management Experience*

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 3 (Evaluation and Qualification Criteria). A separate Form shall be prepared for each item of equipment listed, or for alternative equipment proposed by the Bidder. The Bidder shall provide all the information requested below, to the extent possible. Fields with asterisk (*) shall be used for evaluation.

Form- E Q I

Type of Equipment*		
Equipment Information	Name of manufacturer	Model and power rating
	Capacity*	Year of manufactured
Current Status	Current location	
	Details of current commitments	
Source	Indicate source of the equipment <input type="checkbox"/> Owned <input type="checkbox"/> Rented <input type="checkbox"/> Leased <input type="checkbox"/> Specially manufactured	

The following information shall be provided only for equipment not owned by the Bidder.

Form-EQ-2

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

BIDDER'S QUALIFICATION

To establish its qualifications to perform the contract in accordance with Section 3 (Evaluation and Qualification Criteria) the Bidder shall provide the information requested in the corresponding Information Sheets included hereunder

Form ELI – 1: Bidder's Information Sheet

Bidder's Information	
Bidder's legal name	
In case of JV, legal name of each partner	
Bidder's country of constitution	
Bidder's year of constitution	
Bidder's legal address in country of constitution	
Bidder's authorized representative (name, address, telephone numbers, fax numbers, e-mail address)	

Attached are copies of the following original documents.

1. In case of single entity, articles of incorporation or constitution of the legal entity named above, in accordance with ITB 4.1 and 4.2.
2. Authorization to represent the firm or JV named in above, in accordance with ITB 20.2.
3. In case of JV, JV agreement, in accordance with ITB 4.1.
4. In case of a government-owned entity, any additional documents not covered under 1 above required to comply with ITB 4.5.
5. Organization chart, and list of Board of Directors

Form ELI - 2: JV Information Sheet

Each member of a JV must fill in this form

JV / Specialist Subcontractor Information	
Bidder's legal name	
JV Partner's legal name	
JV Partner's country of constitution	
JV Partner's year of constitution	
JV Partner's legal address in country of constitution	
JV Partner's authorized representative information (name, address, telephone numbers, fax numbers, e-mail address)	

Attached are copies of the following original documents.

1. Articles of incorporation or constitution of the legal entity named above, in accordance with ITB 4.1 and 4.2.
2. Authorization to represent the firm named above, in accordance with ITB 20.2.
3. In the case of government-owned entity, documents establishing legal and financial autonomy and compliance with commercial law, in accordance with ITB 4.5.
4. Organization Chart and list of Board of Director

DETAILS OF PARTICIPATION IN THE JOINT VENTURE

PARTICIPATION DETAILS	FIRM 'A' (Lead Member)	FIRM 'B'	FIRM 'C'
Financial			
Name of the Banker(s)			
Planning			
Construction Equipment			
Key Personnel			
Execution of Works and Operational Services (Give details on proposed contribution of each)			

The Joint Venture should indicate the details of participation as above.

Form LIT- 1: Historical Contract Non-Performance, and Pending Litigation

(to be completed for the Bidder and each member of Joint Venture)

Non-Performed Contracts in accordance with Section 3, Evaluation and Qualification Criteria			
<input type="checkbox"/> Contract non-performance did not occur since 1 st January <i>[insert year]</i> specified in Section III, Evaluation and Qualification Criteria, sub clause 2.1 <input type="checkbox"/> Contract(s) not performed since 1st January <i>[insert year]</i> specified in Section III, Evaluation and Qualification Criteria, sub clause 2.1			
Year	Non- performed portion of contract	Contract Identification	Total Contract Amount (INR)
<i>[insert year]</i>	<i>[insert amount and percentage]</i>	Contract Identification: <i>[indicate complete contract name/ number, and any other identification]</i> Name of Employer: <i>[insert full name]</i> Address of Employer: <i>[insert street/city/country]</i> Reason(s) for nonperformance: <i>[indicate main reason(s)]</i>	<i>[insert amount]</i>
Pending Litigation, in accordance with Section III, Evaluation and Qualification Criteria			
<input type="checkbox"/> No pending litigation in accordance with Section III, Evaluation and Qualification Criteria, Sub-clause 2.2. <input type="checkbox"/> Pending litigation in accordance with Section III, Evaluation and Qualification Criteria, Sub-clause 2.2 indicated below.			
Year of Dispute	Amount in dispute (INR)	Contract Identification	Total Contract Amount (INR)
		Contract Identification: _____ Name of Employer: _____ Address of Employer: _____ Matter in dispute: _____	

PART I: BIDDING PROCEDURES

		<p>Party who initiated the dispute: ____ <i>[indicate "Employer" or "Contractor"]</i></p> <p>Status of dispute: _____ <i>[Indicate if it is being treated by the Adjudicator, under Arbitration or being dealt with by the Judiciary]</i></p>	
		<p>Contract Identification:</p> <p>Name of Employer:</p> <p>Address of Employer:</p> <p>Matter in dispute:</p> <p><i>[indicate "Employer" or "Contractor"]</i></p> <p>Party who initiated the dispute:</p> <p>Status of dispute:</p> <p><i>[Indicate if it is being treated by the Adjudicator, under Arbitration or being dealt with by the Judiciary]</i></p>	

Form FIN – 3.1: Financial Situation and Performance*(to be completed for the Bidder and each member of Joint Venture)***1. Financial data**

Type of Financial information in (INR)	Historic information for previous _____ years, _____ (amount in INR)				
	Year 1	Year 2	Year 3	Year 4	Year 5
Statement of Financial Position (Information from Balance Sheet)					
Total Assets (TA)					
Total Turnover					
Total Liabilities (TL)					
Total Equity/Net Worth (NW)					
Current Assets (CA)					
Current Assets + Loans & Advances					
Current Liabilities (CL)					
Current Liabilities & provision					
Working Capital (WC)					

PART I: BIDDING PROCEDURES

Information from Income Statement					
Total Revenue (TR)					
Profits Before Taxes (PBT)					
Profits after Tax					
Cash Flow Information					
Cash Flow from Operating Activities					
Net cash accruals= Profit after Tax + depreciation					
This information should be extracted from the Annual Financial Statements/ Balance sheets, which should be enclosed. Year 1 will be the latest year for which audited financial statements are available. Year 2 shall be the year immediately preceding year 1 and year 3 shall be the year immediately preceding Year 2.					

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)
1		
2		
3		

3. Financial documents

The Bidder and its parties shall provide copies of financial statements for last 5 years pursuant Section III, Evaluation and Qualifications Criteria, Sub-clause 3.2. 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

PART I: BIDDING PROCEDURES

parent company or group member).

(b) be independently audited or certified by a Chartered Accountant.

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

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

Attached are copies of financial statements⁸ for the _____ years required above; and complying with the requirements

⁸ 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

Annual turnover data (construction only)	
Year	Amount in INR
<i>[indicate year]</i>	<i>[insert amount]</i>
Average Annual Construction Turnover *	

* See Section III, Evaluation and Qualification Criteria, Sub-clause 3.2. Annual construction turnover calculated as total certified payments received for work in progress or completed, for 5 years. This should be certified by a Chartered Accountant.

JOINT VENTURE

Names of all partners of a joint venture
1. Member in charge
2. Member
3. Member

Total value of annual construction turnover, in terms of work billed to clients, in Rupees

Annual Turnover Data (construction only; in INR *)							
Member	Form 2 page no.	Year 1	Year 2	Year 3	Year 4	Year 5	Average
1. Member in charge							
2. Member							
3. Member							
TOTALS							

*** To be certified by a chartered accountant**

Name and address of Bankers to the Joint Venture

EXPERIENCE IN SIMILAR WORKS

Form EXP - 4.1

Starting Year	Ending Year	Contract Identification	Role of Bidder	Status of Project ⁹
		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: _____		
		(add more rows if required)		

⁹ Mention whether the project is Complete or under progress.
 If it is under progress mention % of work complete.
 All above statements should be backed by corresponding experience certificate from respective Employers.

Form EXP 4.2

Specific Experience

SN	Contract Details	Elements Executed	Unit	Quantity executed ¹⁰	Value in Rs.
1	Contract name: _____ Year of completion: _____ Amount of contract: _____ Name of Employer: _____ Address: _____ If the contract was in JV mention bidder responsibilities and achievement.				
2	Contract name: _____ Year of completion: _____ Amount of contract: _____ Name of Employer: _____ Address: _____ If the contract was in JV mention bidder responsibilities and achievement.				

¹⁰ All quantities mentioned and the values indicated should be backed by respective certificates from the Employer.

Form EXP 4.2 A

Specific Experience on traditional Architecture

SN	Contract Details	Elements Executed	Unit	Value in Rs.
1	Contract name: _____ Year of completion: _____ Amount of contract: _____ Name of Employer: _____ Address: _____ If the contract was in JV mention bidder responsibilities and achievement.			
2	Contract name: _____ Year of completion: _____ Amount of contract: _____ Name of Employer: _____ Address: _____ If the contract was in JV mention bidder responsibilities and achievement.			

Bidder's Declaration on Affidavit

Date:

Bid No.:

Invitation for Bid No.:

To: CEO, GSCDL, Sokaythang, Gangtok.

We, the undersigned, declare that:

1. We have seen the Section 6A: Standard Specifications and we have studied and understood all the Clauses of this Section. We accordingly offer to design, execute and complete the said Works and remedy any defects therein, fit for purpose in conformity with the relevant Clauses of this Section.
2. We further undertake to accept that these form a part of our bid and we agree to sign these at the time when the contract agreement is executed.

Dated this _____ day of _____ 20_____.

Signed and Sealed by : _____

In the Capacity of : _____

Name and Address of Bidder : _____

(Affix company seal)

LETTER OF FINANCIAL PRICE BID

Date:

Bid No.:

Invitation for Bid No.:

To: CEO, GSCDL, Sokaythang, Gangtok.

We, the undersigned, declare that:

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

(b) We offer to execute in conformity with the Bidding Documents the following Works:

CONSTRUCTION OF CULTURAL AND CONVENTION CENTRE AT GANGTOK, SIKKIM INCLUDING DEFECT LIABILITY PERIOD OF ONE YEAR

(c) The total price of our Bid, excluding any discounts offered in item (d) below is:

(d) The detailed breakup of the Bid is given in the Price Schedule From of the Bid

(e) The discounts offered and the methodology for their application are: INR

(f) Our Bid shall be valid for a period of as specified in the BDS ITB 18.1 (or as amended if applicable) _____ (fill the number of days as per ITB 18.1) from the date fixed for the bid submission deadline in accordance with the Bidding Documents, and it shall remain binding upon us and may be accepted at any time before the expiration of that period;

(g) If our Bid is accepted, we commit to obtain a performance security in accordance with the Bidding Documents;

(h) We have paid, or will pay the following commissions, gratuities, or fees with respect to the bidding process or execution of the Contract: **

Name of Recipient	Address	Reason	Amount
.....
.....

PART I: BIDDING PROCEDURES

- (i) We understand that this bid, together with your written acceptance thereof included in your notification of award, shall constitute a binding contract between us, until a formal contract is prepared and executed; and
- (j) We understand that you are not bound to accept the lowest evaluated bid or any other bid that you may receive.
- (k) We agree to permit GSCDL or its representative to inspect our accounts and records and other documents relating to the bid submission and to have them audited by auditors appointed by the GSCDL.
- (l) If awarded the contract, the person named below shall act as Contractor's Representative.

Name

In the capacity of

Signed
.....

Duly authorized to sign the Bid for and on behalf of

Date

****if none has been paid or is to be paid, indicate "none"**

PRICE SCHEDULES

Sr. No	Ref.:- Section 6, Clause No.	Particulars	Unit	Number	Quantity SQm/Lumpsum	Rate (inINR)	Amount (in INR)
1	2	3	4	5	6	7	8 (6x7)
1	2.1	Building block	Sqm	1	3786.00		
2	2.2	Interior works	LS	1 job	----		
3	2.3	Parking block	Sqm	1	675.00		
4	2.4	Compound Wall	m	1	245.00		
5	2.5	Development of Arrival Areas, road development, and site stabilization	LS	1 job	-----		
6	2.6	Furnishing, Furbishing and furniture	LS	1 job	-----		
7	2.7	Dismantling existing structures and throwing of debris & spoils	LS	1 job	-----		
8	2.8	Sound & Security system	LS	1 Job			
9	2.9	Rainwater harvesting, Renewable energy.	LS	1 Job			
10	2.10	External/ Common areas Services (Provision for	LS	1 Job			

PART I: BIDDING PROCEDURES

Sr. No	Ref.:- Section 6, Clause No.	Particulars	Unit	Number	Quantity SQm/Lumpsum	Rate (inINR)	Amount (in INR)
		External Water Supply, Sanitation and Electrification)					

Section 5- BILL OF QUANTITY

Sr. No	Ref.:- Section 6, Clause No.	Particulars	Unit	Number	Quantity SQm/Lumpsum
1	2	3	4	5	6
1	2.1	Building block	Sqm	1	3786.00
2	2.2	Interior works	LS	1 job	----
3	2.3	Parking block	Sqm	1	675.00
4	2.4	Compound Wall	m	1	245.00
5	2.5	Development of Arrival Areas, road development, and site stabilization	LS	1 job	-----
6	2.6	Furnishing, Furbishing and furniture	LS	1 job	-----
7	2.7	Dismantling existing structures and throwing of debris & spoils	LS	1 job	-----
8	2.8	Sound & Security system	LS	1 Job	----
9	2.9	Rainwater harvesting, Renewable energy.	LS	1 Job	----
10	2.10	External/ Common areas Services (Provision for	LS	1 Job	----

PART I: BIDDING PROCEDURES

Sr. No	Ref.:- Section 6, Clause No.	Particulars	Unit	Number	Quantity SQm/Lumpsum
		External Water Supply, Sanitation and Electrification)			
11	2.11	Landscaping of the complex	LS	1 Job	-----

PART II

EMPLOYER'S REQUIREMENTS

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Section 6 - WORKS REQUIREMENTS

1. GENERAL SCOPE OF THE WORKS

- 1.1. Gangtok, the capital of Sikkim has been selected in the Stage-III of INDIA SMART CITY MISSION Projects. Gangtok in its new age lacks a cultural centre where culture and custom of different ethnic groups can displayed , research and its evolution to the present context can be studied and interpreted for generation to come. Sikkim has its uniqueness in having rich and varied culture within a small population and its area. The complex shall have a convention centre to host cultural and indoor exhibitions relevant to its context.

The project “**CONSTRUCTION OF CULTURAL AND CONVENTION CENTRE AT GANGTOK, SIKKIM INCLUDING DEFECT LIABILITY PERIOD OF ONE YEAR**” at Gangtok, while it aims to bring in new infra structures of preservation of culture and space of understanding, discussion and way forward of its evolution. The site of this project has been earmarked at present MLA hostel, Gangtok.

2. Scope of work

The work involves design and construction of structures keeping in view the traditional architecture of the past and present. Further all new construction and landscaping shall be so envisage the existing ambience of the surrounding.

All drawings need to be approved by the concerned authorities before execution on site. All below items should be as per good engineering practices and to the satisfaction and approval of Project Manager/appropriate authority appointed by GSCDL. The buildings and other components below should be fit for the designated purpose of use.

All soil tests and stability tests to find bearing capacity of soil, soil stability of area and structural analysis required for design of all structures should be taken into consideration in preparation of designs of new structural designs and shall be sole responsibility of the contractor/firm engaged for carrying out the work.

Green Building rating systems to be included and since it is a process therefore the rating will be based on it so more compliance means more efficient output and thus higher ratings.

2.1. Construction of main building block

Construction of six storey building with each floor having having a built up area as shown in drawing attached with this RFP in RCC framed structure with floor height of 3 to 3.5m. The RCC framed structure has to be designed in accordance with standard of specification of Sikkim PWD duly conforming to relevant IS Codes including seismic codes. All designs have to be submitted to the Project Manager for approval. RCC framed structure with cement concrete brick/ normal bricks, walls plastered with cement mortar on both sides finished, with acrylic emulsion on internal walls and Acrylic exterior paints on exterior walls. All doors, windows, ventilators will be in timber frame, with glazing from a reputed brand like M/s. Saint Gobain, M/s. Asai Glass M/s. Modi Guard, or equivalent & also all fittings and fixtures to be of brass of reputed brands like M/s. Brass Arts (India) Pvt Ltd M/s. Vijay Industrial Eng Corp. or

equivalent. The flooring in common areas shall be of 25mm TK Kota stone flooring or 2 feet by 2 feet vitrified tiles, floor laminates in rooms and glazed anti-skid tiles in bathrooms. Bathrooms will also have glazed anti-skid tiles on walls till 1.7m. The roof shall be designed as sloping roofs supported on steel truss covered with GI sheets and with adequate provision for gutters to facilitate rain water harvesting. Fire-fighting systems need to be provided as per standards. The design should be based on the General Arrangement drawings attached as Drawing number MQ(I)

The building design and architecture shall conform to the design principles and aesthetics of traditional architecture and should incorporate paintings on external surfaces, internal surfaces, doors and windows as per directions of authority.

The building shall have provisions for adequate water supply by being connected to the main source or other source of water supply and shall have provisions for both hot and cold water. The plumbing shall be concealed with adequate points of supply wherever required and as approved by the Project Manager. The plumbing fixtures shall be of reputed brands like M/s. Hindware, M/s Simpolo, M/s. Cera or equivalent. The building shall also have adequate provision for safe and sanitary disposal of grey water and other waste water through connection with the existing sewer network or through onsite sanitation systems like septic tank, etc. The electrical work shall be done by providing adequate switches for lighting, heating, cooling and charging requirements of the residents. All electrical wiring and fixtures should be of reputed brands like M/s. MK, M/s. Crabtree M/s. Legrand or equivalent as approved by the Project Manager

2.2. Interior works:

The interior works shall be befitting interior of the building and its scope of work. Detailed drawing and specification has to be submitted after approval of main building block drawings. All necessary modifications shall be accorded as when a particular section / part has been completed as drawing of main building.

2.3. Parking Blocks:

A automatic parking block annexed to main building block has to be constructed to facilitate parking of vehicles of visitors to the cultural centre. Each floor of the parking shall be 225.00 square feet. The total numbers of floors of parking block shall be three numbers only.

2.4. Compound Wall:

A compound wall of RCC column of 2.40 metre height from the ground and spaced at 3.0 metre with six ply barbed wire horizontal and two diagonals along the boundary of the complex for demarcating the site.

2.5. Development of Arrival areas, road development and site stabilization:

The arrival areas of the cultural and convention centre should be designed as comfortable and there is need to realign the present plans existing at this place. Certain areas of road going down to the High Court has be realigned and developed to accommodate the present proposal. Periphery of the site consists highly valued buildings like All India Radio complex, on going construction site of GYAN Mandir and high Court Building. Site needs requisite site

stabilization as per condition of prior or during construction to enable the new complex stable as needed by rules and codes.

2.6. Furnishing, Furbishing and Furniture:

The building block should be appropriately and adequately furnish, furnish and furniture befitting the centre and its components. Final drawing should include all components shown and approved by Project Manager or designated authority.

2.7. Dismantling of existing structure and throwing of debris & spoils

The present structures are to be dismantled and removed from the site for construction of proposed project. The debris should be stored and disposed at designated spot or approved spots by the concern authority.

2.8. Sound & Security system

A proper sound and security system has be to designed as per project envisages by the intending bidders. All specification are to be approved by the Project authority before any procurement or installation. Installation of Security systems which would include perimeter protection, alarm systems, security lighting, closed circuit TV among others causing minimal intervention to the existing historical fabric of the site. Also components like camera PTZ Optical Zoom 4MP, IP Bullet or Dome 4mm upto 4K, NVR 4 Sata 4MP upto 4K, Hard Disk of Minimum 4TB Storage, POE Switch 8 way Giga, CAT 6 D-link, LED FHD 32 X 2, Camera Stand, Bose 251 or equivalent outdoor speakers, Bose F1 812 or equivalent flexible array loudspeaker, Pioneer channel Amplifier class D3 Network or equivalent with all accessories with providing and fixing charges all including should be as approved by the Project Manager. The Security systems installed should be of high standards and of reputed brands like M/s Zicom, M/s Godrej or equivalent. Sounds and Security systems should be enough for covering whole compounds, different areas and also all secluded areas where security is inaccessible by guard physically.

2.9. Rain water Harvesting and renewal energy

Proposed building should have provision for rain harvesting units to cater to at least two days of storage and fire fighting requirements. The landscaping of the compound should be designed in such a way that roof top water and surface runoff of rainfall should be collected in open channels which flows into different groundwater recharge pits at different locations according to the topography of compound as per approved design from the Project Manager. Groundwater recharge pits should have arrangements to filter/settle all particulate matters in rainwater before water is percolated down pits for ground water recharge, including RCC design and construction of 1.2

2.10. External Services

On the execution of the project there shall be enhancement of requirement of energy and water supply. The design should incorporate the up gradation of existing transformer and its panel to suit the requirements. The water supply main pipeline has be to upgraded to meet

additional and continuous water supply in the cultural and convention. Provisions for connecting all buildings (existing and new buildings) in compound with main source (PHE water supply) of water supply with all external water supply systems, dual hot water systems including pipes, fixtures, etc. including all providing and fixing charges complete as approved by the Project Manager. Common water heating systems powered by solar power with stand-by power source arrangements for all the buildings in compound as approved by Project Manager.

2.11. Landscaping of the complex.

Area remaining should be trained and landscaped. The design should be earthy, environmentally friendly. The intervention of concrete or ceramic material should be minimum. More emphasis should e given on the stone materials. The landscaped architecture should blend with existing surrounding.

A Standard Specifications

List of Materials and Proposed schedule of finishes for the construction of new buildings in the Compound. Contractor has to take prior approvals of all materials, fixtures and finishes to be used from the Project Manager / appropriate authority appointed by GSCDL before procurement.

Materials	Specifications
Cement	43,53 Grade
Sand	Tar Khola or its equivalent
Stone chips	Government approved quarry
Door Frames	Sal/Katus
Door Shutters	38mm TK blockboard with bothside with clamp/teak lipping
Windows	Wooden flung open / Aluminum / UPVC
Bricks	Cement Concrete (20x10x10)
Cement Plaster	1:4
GI Sheet	22 BWG TATA or equivalent (As per sample approved)

PART I: BIDDING PROCEDURES

Flooring	
Corridor	Kota Stone
Toilet	Somany / Kajaria or equivalent
Steps	Green Marble
Reinforcement Fe415,500	TATA / SAIL or equivalent
Concrete RCC	M25
Fixtures	
A Cock / L Cock / Shower head / Health Faucet	Esco / Jaguar or equivalent
Sanitary Hardware	Hindware / Simpolo / Cera or equivalent
G.I. Pipe	Medium with high quality fibre with ISI Mark
Luminaries and Electrical Fitting (All concealed wiring)	
Wire	Fire Proof
Switches/Socket	MK / Crabtree / Legrand or equivalent
Luminaires	Philips or equivalent
Transformer	100kVA with armoured cable of appropriate design

(The bidder is required to sign the declaration as given in section 4 (Bidding forms) and submit along with the bid.)

In addition to above declaration relevant national and international standard specifications are to be referred and taken into consideration for the bid.

6B Special Specifications:

- (i) The works would be quoted for all lead and lift unless otherwise specified particularly in the document.
- (ii) The Employer does not undertake to construct or make available any approach road to the proposed worksite if not mentioned in the Bill of Quantities and the bidder shall get acquainted with available means of approaches to the proposed site and quote for various items. The Employer shall not be liable for any claim raised later on the plea of non-availability or non-access to the site.

1.1. General

All the materials incorporated in the works shall be the most suitable for the duty concerned and shall be new and of first class commercial quality, free from imperfections and selected for long life and minimum maintenance. It shall be tested according to relevant IS Specifications in qualified labs and certificates produced to the satisfaction of the Project Manager.

If the specification for a particular item is not given, the Standard Specifications of Sikkim PWD or WSPHED or CPWD shall be followed.

The objective of the specifications given in this section is to specify the details pertaining to the design, drawing, and selection of equipment or product. The equipment or product supplied shall be of high standard of quality and best engineering practices and shall comply with all currently applicable standards, regulations and codes.

Except as otherwise specified in this technical specification, the Indian/International Standards and Codes of Practice in their latest version shall be adhered to for the design, manufacturing, inspection, calibration, installation, field testing, packing, handling and transportation of product.

Should any product be offered conforming to other standards, the equipment or products shall be equal to or superior to those specified and the documentary confirmation shall be submitted for the prior approval of the Employer.

6C Drawings

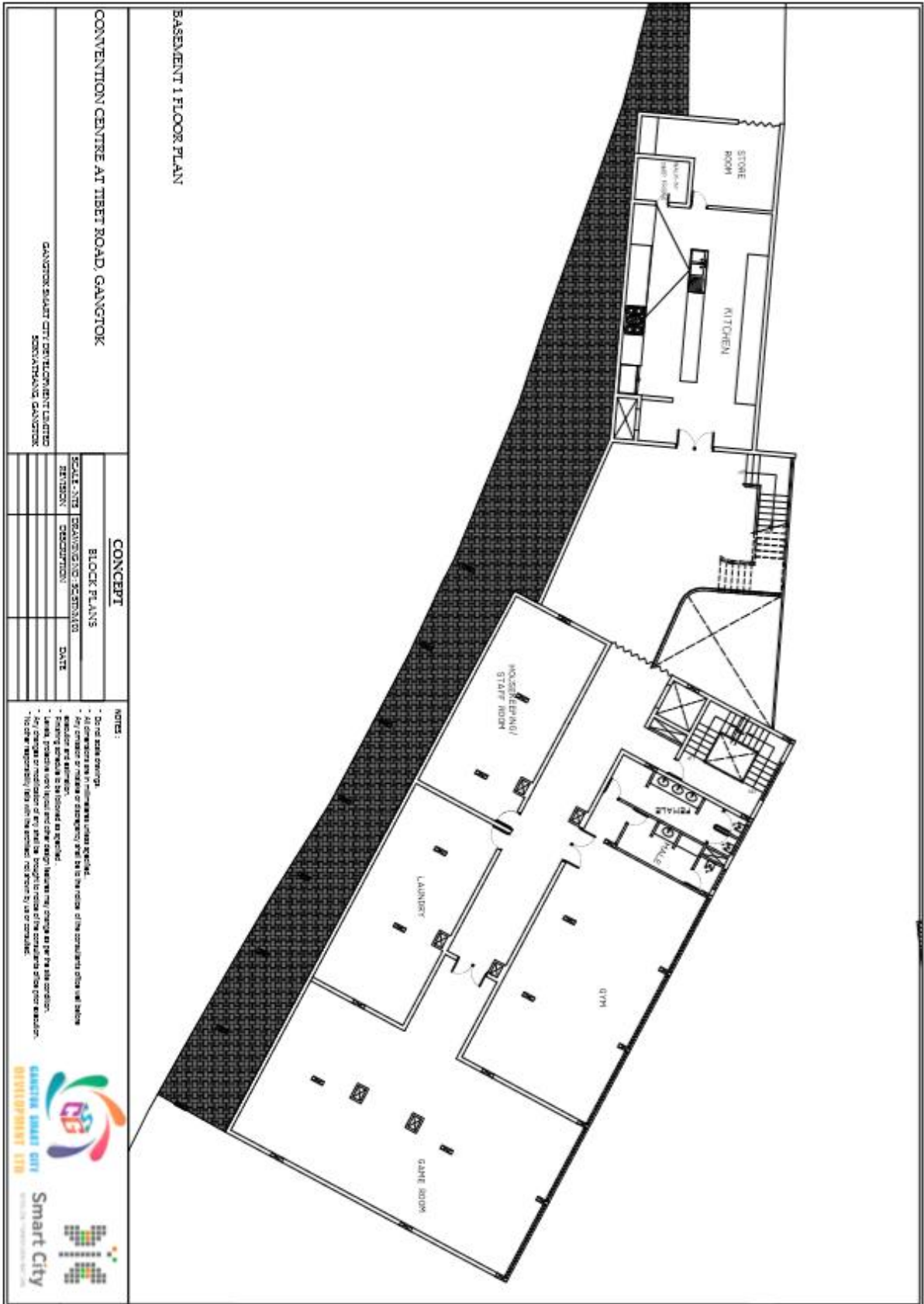
1. **Employer's Drawings:** -The drawings listed in the Tender document are Employer's drawings and are provided by the Employer as a guideline of the specifications and work only. All data and information furnished in the drawings by the Employer is given in good faith but the Employer does not accept the responsibility for the completeness and accuracy thereof. The same shall be verified by the contractor promptly pointing out errors or discrepancies thereof to the Engineer.
2. **Contractor's Drawings:** -All drawings provided by the Contractor shall be on standard size sheets, prepared on computer with Auto CAD Latest revision and shall show particulars in a title block located in the lower right hand corner, in addition to the name of Contractor and equipment manufacturer, date,

PART I: BIDDING PROCEDURES

scale, drawing, revision number (R0 for drawings submitted initially, R1, R2 etc. for drawings submitted subsequently). A blank space shall be provided for the Engineer's approval stamp and provision shall be made for detail of revisions to be recorded. All drawings submitted by the supplier shall use the English language. All drawings shall be clearly and fully cross-referenced to the other drawings as relevant.

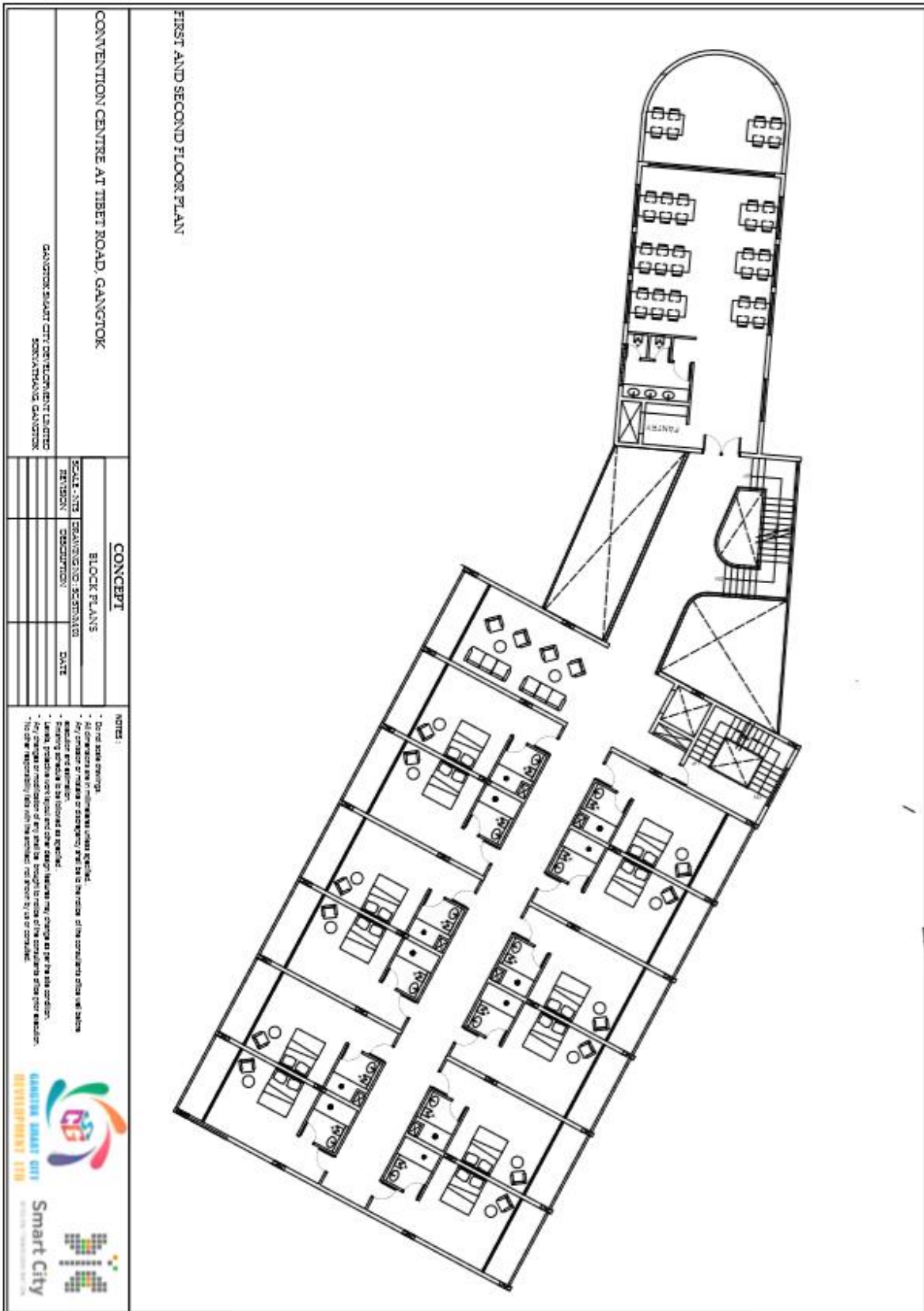
Table 1: List of Drawings

SI No.	Description/ Name of the Buildings	Drawing title	Drawing no.
1	Level (-) 2	Level (-) 2	1
2	Level (-) 1	Level (-) 1	2
3	Level 0	Level 0	3
4	Level 1 & 2	Level 1 & 2	4
5	Level 3	Level 3	5

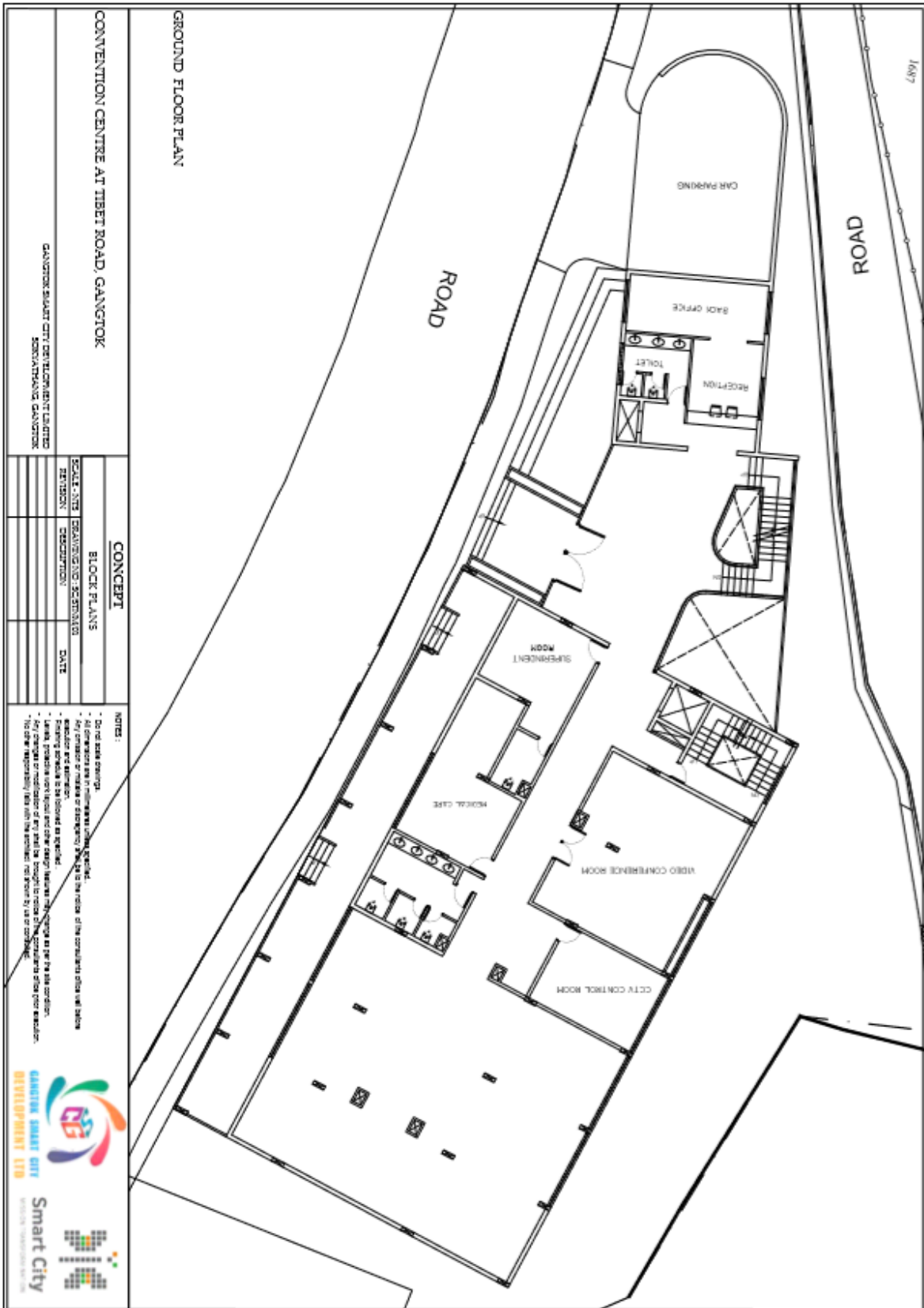


Drawing No: 2

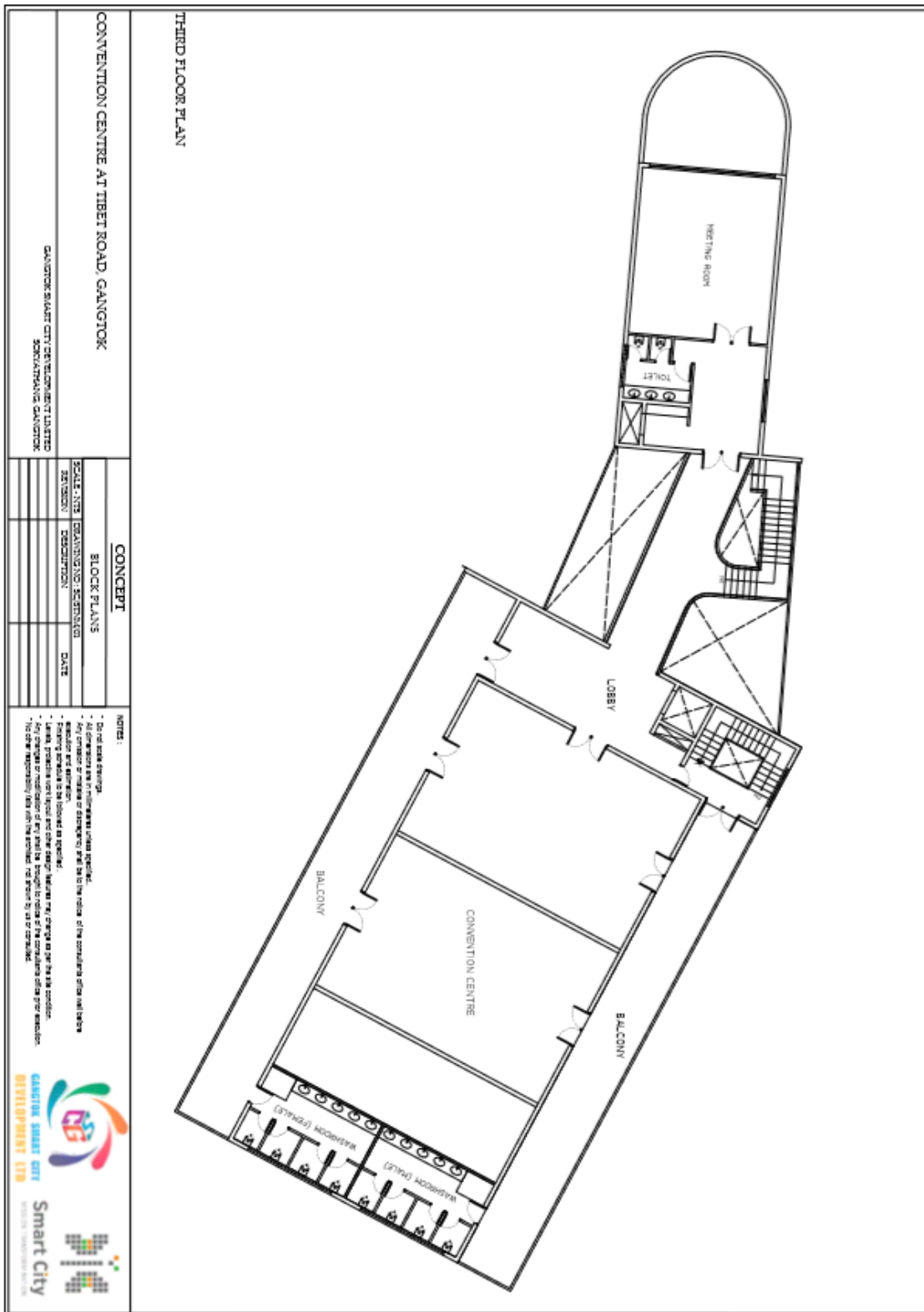
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SCOPE OF WORK

Following are the project components for specified designs; however, the Employee can propose minor modifications to the design/ drawings provided to him to quote for the works, based on the formwork technology intends to propose and implement for these housing project. Further the vendors' proposal should be depending upon mentioned components and specifications with respect to conditions set forth.

The work shall be executed on Turnkey basis from conception to commissioning services including soil investigation, all necessary engineering survey, construction, designing, method of erection in accordance with layout plan and detailed architectural / structural drawings duly approved as specified by GSCDL.

- i. Scope of work contained in the paragraphs mentioned below is only indicative and not exhaustive. In addition, the contractor shall be responsible for executing all items required for completing the houses in all respect to make the dwelling units habitable and ready for occupation including all services, environment-fit for habitation with electrical, landscaping works complete as per direction of Project manager/ appropriate government authority appointed by GSCDL.
- ii. Contractor will have to prepare the layout plan and detailed architectural drawings to be approved as specified by GSCDL for this scheme within the development control norms of Gangtok Municipal Corporation. The design shall be prepared by Conceptualization, planning ,structural designing, structural proof checking and all other internal & external amenities like Plumbing & sanitation, Drainage, Electrification ,storm water drainage, Horticulture ,Fire safety ,Infrastructural facilities like RCC roads, Development of marginal space by VDS Concrete/Paver Block pavement, compound wall, entry gate ,COP Development ,Street lighting etc. work in accordance with the provisions of this Agreement and in conformity with the requirements and maintenance of the Project in accordance with the provisions of this Agreement
- iii. Survey of the boundary of the plot(s) including topography of the plot with Total station, or any other survey (s) required during the execution of the project.
- iv. The maximum permissible FSI as per the GMC building rules need to be taken into consideration and the plot area for each Package is mentioned in this tender document. Bidder has to plan as per details given in minimum specific planning requirement clause no: 1.2 given above and accommodate maximum Nos. units. Bidder has to plan Maximum permissible number of Dwelling Units per floor/Building block nos. should be designed with the minimum at 240 dwelling units with maximum light and ventilation.
The scope of work for the agency shall include from conceptualization to the possession to the customer /authority i.e. shall include preparation of layout (as per the rules and guideline of Gangtok Municipality and unit plans with cluster in the form of presentation for the approval of the competent authority with min. 2 to 3 alternatives (but not limited to nos. of alternatives until the satisfactory approval from Project Manager/ Employer).
- v. The overhead water tanks (separately for each building as per requirement) shall be of the capacity to retain water at the rate of 150 LPCD + free board. Required fire tank provisions shall also be made .All flats to be provided with individual water meter connection

- vi. The project shall include provision for proper and safe disposal of black and grey water using appropriate technology as per approved design.
- vii. Contractor will get the all the statutory clearance from the Prescribed Authority / Project manager/ appropriate government authority appointed by GSCDL as and where required.
- viii. Contractor will get the detailed soil investigation done as per relevant IS code, NBC 2005 etc. as applicable through any nationally accredited lab. The department may verify the results submitted by the agency, if need be.
- ix. Tender may satisfy himself by conducting pre soil test if he so required.
- x. Prepare complete structural design, drawing for foundation, super structure and for other related structures in the housing pocket to be provided in this housing scheme as per provision contained in IS code/ relevant codes
- xi. Provision of protection against seismic forces as per relevant IS codes for structure in Sikkim.
- xii. The structural drawing shall be approved as specified by GSCDL & charges if any shall be borne by the agency. If any modification in design/ drawing is needed, as per site conditions, the agency shall do/ redo without any extra cost. The decision of the GSCDL shall be final and binding. No claim what so ever will be entertained in this regard.
- xiii. Construction includes construction and finishing of the flats complete as well as related structure in this housing pocket as per specifications provided by GSCDL.
- xiv. Planning, preparing drawing for internal services and execution of the same i.e. internal sanitary work, water supply work, drainage system etc. complete for the building including all pipes, its fittings, testing etc. complete.
- xv. Water supply:
Water supply lines will be laid as per scheme prepared, submitted by the contractor and to be approved as specified by GSCDL.
Planning, designing and construction/ installation of water reservoirs, water gallery pump houses for water supply, for fire-fighting tank including installing of pumps, standby pumps, DG sets (if need be) etc. as per approved drawings/ specifications or as directed by Project manager/ appropriate government authority appointed by GSCDL.
- xvi. Sewerage:
 - a) Refuse area will be constructed in the building.
 - b) Internal storm water drain (pipe/ open surface drain) to be designed and constructed with connection to the nearest existing Jhora along the site. Responsibility of getting storm water drain approved is included in the scope of work/tender.
- xvii. Planning, designing and execution of all services like water supply, sewerage, drainage system, roads, paths and all connected sub structures and super structures within the premises, as per bye laws and norms of the local bodies including making connections with the peripheral services after getting the services design approved from the local bodies/ Central Ground Water Board, GSCDL's role shall be limited only to sign the application/ drawings / documents for submission to the local bodies in the capacity of the owner for approval. In case of water supply, the responsibility of getting the scheme approved from service provider (Municipal Corporation/ULB) is included in the scope of work/ tender apart

from internal and external water supply lines to be laid to make the system of water supply functional/ complete. However, the cost of connection of water supply lines from peripheral connection point shall also be borne by agency. It is also clarified that scope of work/tender includes cost of getting the services approved from the services provider as aforesaid and the services charges including supervision charges, if any, payable to the service provider. The cost of deficiency charges and rectifications of any defect at the end of the job is also to be borne by the contractor.

xviii. Landscaping:

Preparation of landscaping plan including parks, plantation and execution of the same with following:

- a) The development of park: water hydrants, grassing creeper planting trees etc. complete as per Municipal Corporation/ULB norms as per specification and drawing approved by the prescribed authority of GSCDL.
- b) Complete levelling/ dressing including filling of earth, its supply, disposal of surplus earth, (if any) shall be the property of SMC & will be disposed to the approved disposal point or at the place as directed by Project manager/ appropriate government authority appointed by GSCDL. No extra payment for disposal shall be allowed.

xix. The disposal of construction and demolition waste shall be responsibility of contractor.

xx. Planning, designing and construction of boundary wall for the whole scheme area, MS gate, dustbin, sign boards, guide map, location board, direction boards, numbering of housing etc. All complete as per drawing approved by GSCDL.

xxi. Taking all precautionary measure to safeguard against any accident for the contractor employees, general public, supervisory staff of GSCDL by providing necessary safety equipment's, helmets and MS sheet barricading etc. at work site. The site has to be kept clean all the time of all debris, rubbish, dirt & surplus/waste material.

xxii. De-silting will also be done by the agency before handing over the completed housing pocket to GSCDL. All machine, equipment and labour for this purpose will be arranged by contractor.

xxiii. The Contractor will submit the model for layout of the project specifying details provided in layout along with in the tender documents in one month from stipulated date of start. He will also submit a model of modules of houses specifying all floors and its adjoining area. The scale of module shall be 1:500 for layout plan and 1:100 for dwelling unit.

xxiv. Internal & external electrification work as per specification given in the tender document & directions of GSCDL as per scope of work & specifications appended with the NIT which includes LT supply, water supply arrangement, firefighting, lifts and DG sets, for both the interior and exterior of buildings.

xxv. Agency has to obtain labour license from Labour welfare board.

xxvi. Defect liability period would be uniformly seven years from the date of handing over the respective housing pocket complete in all respect & fit for occupation. However, maintenance of other building activities, such as cleaning, sweeping of pocket & desilting of sewer lines, S.W. Drain shall be done only once prior to handing over the

respective pocket. The maintenance will be only limited to removal of defects noticed in the work carried out by the agency during defect liability period.

- xxvii. The final ground level will be decided soon after actual start of work to avoid water logging at site.
- xxviii. The scope as described above is only indicative and not exhaustive. In addition to the above the contractor shall be responsible for executing all the items required for completing the houses in all respect to make the dwelling units habitable and ready for occupation and also all services, make the environment fit for habitation with electrical, horticultural, rain water harvesting works complete as per direction of Project manager/ appropriate government authority appointed by GSCDL. The above scope of work includes cost of all materials, manpower, equipments, T&P fixtures, accessories, royalties, taxes, watch & ward, and all other essential elements for completion and maintenance of works as aforesaid whatsoever the approval accorded by GSCDL before acceptance of tender is only for tender Evaluation. Any change, modification, revision etc. required to be done by GSCDL, local bodies, proof consultants etc. in accordance with applicable standards and tender document will have to be done at contractor's cost and nothing extra shall be payable.
- xxix. Out of 36 months as stipulated project period, the time limit for Planning & Designing shall be maximum 6 months and remaining period 30 months for execution of project. In short the successful contractor has to complete the project within 3 years from the 10th day of issue of work order.

Specifications

BUILDINGS

Sr. No.	Specifications
1.	
1.1	RCC running foundation (with minimum M25 grade concrete) to required width & depth with necessary excavation & PCC bed.
1.2	RCC shear walls with minimum M25 grade concrete - 160mm thick for external and 110mm thick for internal partitions
1.3	RCC Staircase with minimum M25 grade concrete - Waist slab type (Flight width 1500mm, Tread 300mm, Riser 150mm)
1.4	Roof slab with minimum M25 grade concrete
1.5	RCC minimum M25 grade concrete for OHT over staircase headroom (one for Potable water and another for Treated water with partition/ void in between) - Base slab, Side walls & Roof slab
1.6	RCC minimum M20 grade concrete for <i>chajjas</i> to window/ ventilator openings
1.7	Reinforcement to all RCC works as per design/ drawings/ details
1.8	Filling inside plinth either with available earth or with borrowed earth as per requirement consolidation and having 100mm thick PCC M10 bed concrete on top
1.9	Pre-construction anti-termite treatment for excavated areas, inside plinth and around plinth
2	
2.1	Masonry work by using Fly ash bricks (conventional/ IS type) in CM 1:6 - Entrance Built-up steps
2.2	Masonry work of half brick thick wall by using Fly ash bricks (conventional/ IS type) in CM

Sr. No.	Specifications
	1:4 - Toilet ledge wall
3	
3.1	Vitrified tiles flooring & skirting - Living & Dining, Bedrooms, Kitchen etc.
3.2	Vitrified tiles dadoing - For Lobby/ Corridor/ Staircase (1200mm height)
3.3	Anti-skid Ceramic tiles flooring - Bath, WC, Utility, entrance ramp
3.4	Ceramic tiles skirting – Balconies
3.5	Ceramic tiles dadoing
	- For Toilets (1500mm height)
	- For Utility (1100mm height)
	- For Kitchen (600mm above platform)
	- For Wash basin area (600mm above counter slab)
3.6	Cutout Areas/ Shafts (GF level) - Cement concrete flooring 50mm thick with M20 cement concrete, finishing smooth (with crushed sand)
3.7	18mm thick ADONI BROWN LEATHER FINISH stone for flooring & skirting - Main Entrance steps, GF Common Areas
3.8	Polished Kota stone slabs of 25 to 30mm thick for flooring & skirting - GF Staircase area, Staircase steps, GF-Corridor, Upper levels - Lobby and corridor area
3.9	Polished kota stone slab coping over RCC parapet of 160mm/ 110mm thick for Balconies, Utility, Cut-outs etc.
3.10	Polished kota stone slab for window/ ventilator sills and Door thresholds for Bath/ WC/ Toilet
4	
4.1	Main Door - Concrete frame of 125x 60mm and 32mm thick decorative veneered flush shutter, necessary beadings/ lipping on edges, finishing door frame with oil paint and shutter with French polish.
4.2	Internal Doors (with/ without threshold) - Concrete frame of 125 x 60mm and 32mm thick commercial ply veneered flush shutter, finishing door frame & shutter with oil paint.
4.3	Utility doors – Concrete frame with threshold of 125 x 60mm and 32mm thick commercial ply veneered flush shutter, plain aluminum sheet 24g cladding on both sides of shutter upto 1100 mm height, finishing door frame & shutter with oil paint (low VOC).
4.4	PVC door frame and 30mm thick shutter for Toilets (MS frame work cladded with PVC sheet) with necessary stainless-steel fixtures& fastenings.
4.5	Windows - Aluminum (powder coated finish) openable/ fixed windows glazed with 5mm thick clear float glass (low emissivity value coated) with U-value of ≤ 5.7 and SHGC of 0.5, with MS grill work for protection (15 kg/Sqm.) and finishing with oil paint (low VOC).
4.6	Ventilators - Aluminum (powder coated finish) frame & louvered clips with 5mm thick glass louvered panes for louvers and MS grill work for protection (15 kg./Sqm.) and finishing with oil paint
4.7	SS handrail of 40mm dia. pipe & 1.25mm thick, of grade 304, over RCC parapet of 160mm/ 110mm thick for Balconies, Utility, Cut-outs etc.
4.8	Stainless steel of Grade 302 & of 2mm thick for Railing with top handrail of 50mm dia., vertical pipe of 38mm dia. @ 600mm c/cand horizontal pipe of 25mm dia. in three rows for Staircase (upto900mm height).
4.9	Chromium plated fixtures & fastenings and handles for Main door, Stainless steelfixtures & fastenings and handles for Internal doors
5	
5.1	Internal Ceiling & RC surfaces and masonry surfaces to be plastered in CM 1:3 (6mm thick)
5.2	External Concrete surfaces of <i>chajjas</i> to be plastered in CM 1:4, 12mm thick in single coat
5.3	External sand faced plaster to RC surfaces and masonry surfaces, in two coats including mixing with waterproofing compound (base coat of 15mm thick in CM 1:4 & finishing coat of

Sr. No.	Specifications
	6 to 8mm thick in CM 1:4)
5.4	Internal plastered surfaces finished with 24 carat luxury paint of emulsion paint with acrylic putty and acrylic primer coat (of low VOC paints of approved make/ brand to be considered)
5.5	External plastered surfaces finished with anti-peel paint of approved make & approved brand exterior Emulsion paint including exterior acrylic primer coat (heat reflective paint and of low VOC paints of approved make/ brand to be considered)
6	
6.1	Granite kitchen platform including vertical both side polished kadappa stone 25 to 30 mm thick supports with kadappa top 35 to 40 mm thick and polished granite 16 to 20 mm top with side strips of granite at front and both sides of platform raised with two vertical granite supports 15 cm height and top granite of 75 x 40 cm including cutting, opening for sink of required size in kadappa as well as granite, granite strip of 40mm width on exposed platform end including rounding of all exposed edges
6.2	Stainless steel sink 1mm thick & single bowl, size 600 x 510 x 200 mm including coupling, outlet pipe, elbow and other necessary fitting, finishing etc. complete.
6.3	Oval type under counter wash hand basin of 410mm x 560mm size and of special color shade having telephonic black / colored granite slab of 18 mm thick, black kadappa framework including chromium plated coupling bottle Trap using CERA company or approved equivalent oval type wash basin model no. 3448 as per detailed drawing or as directed.
6.4	Terrace waterproofing with brick bat coba, with an average thickness of 150mm, laid to proper slope with ten years guarantee on court fee stamp paper
6.5	Terrace area - Two coats of High Albedo paint having minimum Solar Reflective Index (SRI) 108 (with solar reflectance & thermal emittance tested as per ASTM C 1549 and ASTM C 1371 respectively, VOC less than 10 cc/gm. To provide guarantee for the performance of SRI and also the durability of coating
6.6	Sunken areas of Toilets and OHT - finishing with water proof bedding 25mm thick in CM1:3 and ten years guarantee on court fee stamp paper
6.7	Sunken areas finishing & filling with brickbat coba and seven years guarantee on court fee stamp paper
6.8	PCC of grade M10 - 50mm thick screed concrete over sunken areas
6.9	Toilet / OHT - Internal/ External areas with waterproof plaster in 12 mm thick for dado in CM 1:3
6.10	External flagging/ paving all-round the building (1m to 1.5m width) with concrete of grade M15 and 75mm thick including top surface finished as required.
6.11	Water based Ever Crete Deep Penetrating Sealer (DPS) - For OHT internal (concrete/ plastered) surfaces
7	
7.1	Water Closet (white vitreous china) - Orissa type in common toilet and European type (wall mounted) in attached toilet of dual flush type
7.2	Wash Basin (white vitreous china) - Rectangular 550 x 440 mm with pillar tap and bottle trap. Low flow type
7.3	CP Shower - CP overhead shower, shower arm 2 in 1 wall mixer with CP bend, low flow type.
7.4	Kitchen Sink -Stainless steel 1mm thick single bowl with sink cock, low flow type.
8	
8.1	Soil Pipe - PVC SWR Type B 110 mm diameter
8.2	Waste Pipe - PVC SWR Type B 75 mm diameter
8.3	Vent Pipe - PVC SWR Type B 75 mm diameter

Sr. No.	Specifications
8.4	Rain Water Pipe - PVC SWR Type A110 & 160 mm diameter
8.5	Floor Traps - PVC multi trap size 110 x 75 mm
8.6	Pipe supports - MS Angle welded with expansion bolts, U clamps, washer and nuts and painted with anti-corrosive paint.
9	
9.1	Soil Pipe –Eco-drain SN 8 Nu-Drain UPVC pipes of 110,160 & 200 mm diameter
9.2	Gully Trap - Stoneware trap with Brick chamber with CI cover and frame
9.3	Inspection chamber - Brick chamber with RCC precast cover and frame
9.4	Manholes - Brick conical type 1.2 m at bottom and 0.6 m at top for depth from 1 m to 3 m
9.5	Earth work - As per Requirement in Soft Moorum/ Hard Moorum
9.6	Pipe PCC bedding - 100 mm thick with 1:3:6 PCC bedding for pipes
10	
10.1	Single piping system - for fresh water another
10.2	Pipe includes for all toilet internal, duct and terrace works - CPVC SDR 11 with fittings from 20 mm to 50 mm
10.3	Includes Underground piping, Risers for overhead tanks - CPVC Schedule 40 from 50 mm to 100 mm if any
10.4	Valves (Applicable for all stop, non-return valve and air valve) - Brass Ball Valve from 20 mm to 50 mm dia., CI butterfly valves from 65 mm dia – 100 mm PN 1.6
10.5	Earth work - As per Requirement in Soft Moorum/ Hard Moorum
10.6	Pipe PCC bedding - 100 mm thick with 1:3:6 PCC bedding for pipes
10.7	Water Pumps, sewerage pumps, blowers–of BEE 4 star rating of open well type submersible with level controller with stand- by pumps.
11	
11.1	Contract demand of each dwelling 2BHK -4 KW
11.2	Internal Electrical works shall be done as per the Matrix and typical Electrical Lay outs. Internal electrical installation like wiring, earthing etc. shall be as per NBC 2016 ACB /MCCB of Main Panels 35KA breaking capacity Mcbs-10KA on type CMetering Panels shall be as per Local regulation and practices. Metering Panels shall be with DG bus as well as EB bus. Net metering shall be adopted for common areas
	Energy meter in each panel sub panels shall be of digital type with RS 485 port Distribution Boards are of double door type. Wires-Multi-strand FRLS PVC Copper Wires Conduits_2mm thick FRLS rigid PVC Conduits.
	Switches and sockets -Modular type Light fixtures-LED(energy efficient) type with high lumen output not less than 75 lumen/Watt Earthing as per IS codes Each block shall be provided with Multipair Tag Block housed in MS enclosure with acrylic cover MDF /Sub Lightning protection shall be provided for each block. Common area lighting shall be powered from common metering
	Electrical Power distribution including Illumination level etc. shall be carried out as per IE regulations/Local EB standards and Latest NBC 2016

SITES & INFRA

Sr. No.	Particulars	Remarks	Descriptive Specifications For Works Under Sites And Infra
1.00	BUILDINGS	-	RETAIL BLOCK & SECURITY CABIN
1.01	Structure	-	RCC framed structure with minimum M25 grade concrete for isolated footings, columns, beams & slabs with necessary excavation & PCC bed (M10 concrete)
1.02		-	Reinforcement to all RCC works as per design/ drawings/ details
1.03		-	Filling inside plinth either with available earth or with borrowed earth as per requirement including consolidation and having 100mm thick PCC M10 bed concrete on top
1.04		-	Pre-construction anti-termite treatment for excavated areas, inside plinth and around plinth
1.05	Masonry	-	Masonry work by using Fly ash bricks (conventional/ IS type) in CM 1:6 - Entrance Built-up steps, External/Internal walls. Partition wall with Fly ash bricks (conventional/ IS type) in CM 1:4 with RC stiffener band
1.06	Flooring	-	Polished Kota stone slabs of 25 to 30mm thick for flooring & skirting - Entrance steps, Corridor, Shops, Security cabin etc.
1.07		-	Ceramic tiles flooring – Toilets
1.08		-	Ceramic tiles dadoing for Toilets (1500mm height)
1.09		-	Polished kota stone slab for window/ ventilator sills
1.12	Joinery	-	PVC door frame and 30mm thick shutter (MS frame work clad with PVC sheet) with necessary stainless steel fixtures & fastenings - For Toilets.
1.13		-	Windows - MS box sections frame of size 105x 60mm with 1.25mm thick CR sheet, Sections F4B, F7B & T6 for shutter frame glazed with 3mm thick glass of approved quality (low Emissivity Value coated) with U-value of ≤ 5.7 and SHGC of 0.5 and 12mm square MS guard bars for protection, finishing with oil paint and iron oxidised fixtures & fastening – SecurityCabin.
1.14		-	Ventilators - MS box sections frame of size 105x 60mm with 1.25mm thick CR sheet and 5mm thick louvered glass (low emissivity value coated) panes and MS guard bars for protection, finishing with oil paint and iron oxidised fixtures & fastening - For Toilet.
1.17	Finishes (Plastering & Painting)	-	Internal Ceiling surfaces to be plastered in CM 1:3 (6mm thick)
1.18		-	Internal concrete & masonry surfaces and External concrete surfaces of <i>chajjas</i> to be plastered in CM 1:4, 12mm thick in single coat

Sr. No.	Particulars	Remarks	Descriptive Specifications For Works Under Sites And Infra
1.19		-	External sand faced plaster to RC surfaces and masonry surfaces, in two coats including mixing with waterproofing compound (base coat of 15mm thick in CM 1:4 & finishing coat of 6 to 8mm thick in CM 1:4)
1.20		-	Internal plastered surfaces finished with 24 carat Luxury paint of approved brand Emulsion paint including Acrylic putty and Acrylic primer coats (of low VOC paints of approved make/ brand to be considered)
1.21		-	External plastered surfaces finished with anti-peel paint of approved make & approved brand exterior Emulsion paint including exterior acrylic primer coat (heat reflective paint and of low VOC paints of approved make/ brand to be considered)
1.22	Miscellaneous Works	-	Terrace waterproofing with brick bat coba with an average thickness of 150mm, laid to proper slope with ten years guarantee. Terrace area - Two coats of High Albedo paint having minimum Solar Reflective Index (SRI) 108 (with solar reflectance & thermal emittance tested as per ASTM C 1549 and ASTM C 1371 respectively, VOC less than 10 cc/gm. To provide guarantee for the performance of SRI and also the durability of coating
1.23		-	Internal/ External areas with waterproof plaster in 12 mm thick for dado in CM 1:3
1.24		-	External flagging/ paving all-round the building (1.0 m width) with concrete of grade M15 and 75mm thick including top surface finished as required
2.00	Compound Wall works and MS Grill gate	-	
2.01		-	RC columns and necessary isolated footings with M20 grade concrete, necessary excavation, 300mm thick boulder soling & 100mm PCC bed with M10 concrete.
2.02		-	RC Plinth beam connecting columns at ground level
2.03		-	Reinforcement to all RCC works as per design / drawings/ details
2.04		-	Masonry work by using Fly ash bricks (conventional/ IS type) or locally available bricks as per approval in CM 1:6 - for sub-structure works (between footing and plinth beam)
2.05		-	Masonry work by using Fly ash bricks (conventional/ IS type) or locally available bricks as per approval in CM 1:6 - for super-structure 1.5m height and coping on top with PCC M15 grade concrete
2.06		-	Internal/ External concrete & masonry surfaces to be plastered in CM 1:4, 12mm thick in single coat and flush groove pointing in CM 1:3 (as per drawing/ details). Patti/ Band in CM 1:3, 150mm wide at top.
2.07		-	External plastered surfaces finished with anti-peel paint of approved make & approved brand exterior Emulsion paint including exterior acrylic primer coat (heat reflective paint and of low VOC paints of approved make/ brand to be considered)

Sr. No.	Particulars	Remarks	Descriptive Specifications For Works Under Sites And Infra
2.08	MS Entry Gate	Size-6m x 0.8m	MS grill gate with angle framework, bars @ 150mm c/c and diagonal flats, finishing with oil paint (weight 35 kg./sqm.)
3.00	ROAD WORKS SW DRAINS	-	
3.01	Road Works	-	Excavation for sub-base including conveying of surplus materials away from the site
3.02		-	Subgrade with approved materials, spreading, grading to required slope and compacted to meet requirement, in layers not exceeding 250mm thick and compacting it by mechanical means
3.03		-	Granular sub-base of 200mm thick with Plant mix method and grading 1 material including spreading, compacting etc.
3.04		-	Wet mix macadam in two layers of 125mm each, laying, spreading and compacting of graded stones aggregates as per table 400-11, mixing in wet mix plant, laid with mechanical paver finisher to the required grade, level and alignment, compacting with vibratory roller etc. complete
3.05		-	Bituminous macadam of 50mm thick using crushed aggregates of specified grading, premixed with VG30 grade bituminous binder and transporting the hot mix to work site, laying to the required grade, level and alignment, rolling with smooth wheeled, vibratory and tandem rollers to achieve the desired compaction as per MORTH table 500-10 complete
3.06		-	Bituminous concrete of 40mm thick using crushed aggregates as per table 500-18 of specified graded aggregates and filler (Cement) @ 2% by weight of aggregates, premixed with bituminous binder 60/70 Grade (VG-30) in Batch/ Hot mix plant, laid with hydrostatic paver finisher with sensor control to the required grade, level, alignment, rolling with smooth wheeled roller 8-10 tonnes, vibratory roller 8 tonnes, smooth wheeled tandem roller 6-8 tonnes as per clauses 501.6 and 501.7 to achieve the desired compaction.
3.07		-	Precast kerb stones with top and bottom width 115mm and 165mm respectively, 250 mm high in M20 grade PCC, fixed over M10 grade PCC bed 150 mm thick including necessary earthwork/ refilling etc.
3.08	SW Drains	Connectivity of drains from compound to nearest Jhora for removal of rain water & other waste water.	Excavation for sub-base including conveying of surplus materials away from the site
3.09		-	PCC of mix M10 for bed concrete, RCC of mix M25 grade concrete for bottom & sides of drains including

Sr. No.	Particulars	Remarks	Descriptive Specifications For Works Under Sites And Infra
			necessary formwork, reinforcement etc.
3.10		-	Drain cover slab with RCC M25 grade concrete. Top surface with GSB of 150mm thick and Interlock pavers of 60mm thick set in sand bed. MS grating of approved sample, at every 15m c/c and of size 400x 600mm or as per site conditions
3.11		-	PVC pipe of 110mm dia. for draining water from road surface to drains
4.00	HARDSCAPE PAVEMENT/ PARKING	/-	
4.01		-	Excavation for sub-base including conveying of surplus materials away from the site
4.02		-	Subgrade with approved materials, spreading, grading to required slope and compacted to meet requirement. in layers not exceeding 250mm thick and compacting it by mechanical means
4.03		-	Granular sub-base of 150mm thick with Plant mix method and grading 1 material including spreading, compacting etc.
4.04		-	Interlock paver blocks of 60mm thick for Footpaths/pathways/ Parking, set in sand bed including compacting with plate vibrator etc.
5.00	LANDSCAPING/ HORTICULTURE WORKS	-	
5.01		-	Excavation for sub-base including conveying of surplus materials away from the site
5.02		-	Subgrade with approved materials, spreading, grading to required slope and compacted to meet requirement of table, in layers not exceeding 250mm thick and compacting it by mechanical means
5.03		-	Factory made coloured chamfered edge Cement concrete grass paver blocks of required strength, thickness & size/shape, laid in required colour & pattern over 50mm thick compacted bed of fine aggregate
5.04		-	Planting of trees by the road side (Babul trees) in 0.60 m dia holes, 1 m deep dug in the ground, fixing the tree guard and maintaining the plants for one year complete
6.00	SEPTIC TANK & DISPOSAL		
7.00	ELECTRICAL WORKS (Sites Infra)		

Sr. No.	Particulars	Remarks	Descriptive Specifications For Works Under Sites And Infra
		-	External Electrical works including Transformer, DG, external cabling, external light fixtures and control through suitable timers.
		-	External power distribution by armoured cable in hume pipes of ISNP II Class and of dia. 225/ 300mm including necessary excavation, refilling and chambers of size 60x 45x 90cm at intervals as per details/ drawings
		-	External communication and TV cable in hume pipes of ISNP II Class and of dia. 100mm or HDPE pipes of 100mm dia. including necessary excavation, refilling and chambers of size 60x 45x 90cm at intervals as per details/ drawings
		-	MDF / Sub MDF Floor Tag blocks and required wiring
		-	Main TV hub with splitters / co-axial cable
		-	Suitable lightning protection of early streamer type

PUBLIC HEALTH ENGINEERING – SITES & INFRA

Sr.No.	Particulars	Remarks	Descriptive Specifications For Works Under Sites And Infra
1	Water Storage Tanks	HDPE Tanks 2 nos.(20KL caps. each)	For one day water storage capacity minimum
2	Dual piping system -	Yes	One for fresh water another for flushing water.
3	Internal Roads & SW Drains	-Internal road area=As per design (sqm). - Pathways/Parking areas shall be with precast concrete paver blocks of 60mm thick, set in sand. -SW drains.	Bituminous paved surface, Pathways/ Parking areas - Interlocked pavers, SW drains - RCC box type
4	Compound Wall works	Compound wall length =245.0m	With block masonry and necessary foundation,
5	Landscaping/Horticulture works	Landscape =sqm. Grass pavers =sq. Hardscape=sqm.	Both Soft/ hard scape with avenue trees on roadsides etc. Species shall be native. Min.40% trees shall be drought resistant and also favourable in cold climatic conditions.
6	Electrical Works	Transformer 2 No 500KVA oil filled type Off circuit type Specification: As per IS 1180 IS1180 (part 1) and IS2014 Star 2 as per (Level 3) specification as per Government of Sikkim Winding:copper Tap:+5% to_10% System grounding Solidly Grounded	-
		RMUs-VCB based HT/LT Cables-XLPE PVC armored aluminum	
		Power shall be distributed through LT Kiosk/Feeder Pillars/Metering Panels and UG cables. The cable distribution etc. shall be carried out as per local regulations and practices for layout development. Hume pipes /HDPE pipes of suitable dimensions shall be used for road crossings and cable laying, Commercial areas like shop etc. shall also be powered from the nearest Transformer centers. External lighting comprises of street poles/Bollards and other Landscape light fixtures. The control shall be through External lighting panels with timer controls. Solar powered Independent	

Sr.No.	Particulars	Remarks	Descriptive Specifications For Works Under Sites And Infra
		<p>street light fixtures shall also be provided External infrastructure comprising of HDPE pipes Junction Boxes Cables etc. for Telephone and TV distribution</p> <p>Cable Pulling chambers wherever required shall be provided.</p> <p>ACB /MCCB of Main Panels 35KA breaking capacity MCBs-10KA on type C</p> <p>All required wiring, cabling Panels etc. shall be considered.</p> <p>Power charging sockets comprising of socket with MCB control in weather proof Enclosure with pedestal etc. shall be provided</p>	
		<p>Power distribution schematic drawings which is part of this document shall be for Guidance purpose only. The Local regulation and Practices shall be adopted while designing the scheme.</p> <p>Electrical Power distribution including Illumination level etc. shall be carried out as per IE regulations/Local EB standards and Latest NBC 2016</p>	

CIVIL & FINISHING WORKS AND SERVICES WORKS - LIST OF APPROVED MAKES OF MATERIALS

Sl.No.	Material Description	Approved Makes
1	2	3
1.00	CIVIL AND FINISHING WORKS	
1.01	Cement(43/53 grade)	ACC, Birla Super, Ultratech, Ambuja, Manikghar or Approved Equivalent (with test certificate)
1.02	Reinforcement Steel/ Structural Steel	TISCO, IISCO, SAIL, Vizag, Jindal, Kamadhenu, Lodha or Approved Equivalent (with test certificate)
1.03	Concrete Ad-mixtures and Water proofing compounds	Fosroc, Roff, Sika, Weber, Dr.Fixit, Laticrete or Approved Equivalent
1.04	Flyash Bricks	Approved Sample
1.05	Ready Mix Concrete	ACC/Ultratech/Lafarge or Approved Equivalent (with test certificate)
1.06	Vitrified Tiles/Ceramic Tiles/ GVT	Nitco/ Sunheart/Jhonson/ Somany or Approved Equivalent (with test certificate) (approved sample)
1.07	Kota stone slabs	Approved sample
1.08	Granite slabs	Approved sample
1.09	Door frames/ Window frames	Approved sample
1.10	Hardware fixtures (Doors/ Windows)	Classic/ Beeta/ITSA Or or Approved Equivalent (with test certificate)
2.00	PUBLIC HEALTH ENGINEERING WORKS	
2.01	Sanitary Ware	Hindware / Parryware / Soncera/ Jaquar or Approved Equivalent (with test certificate)
2.02	Sanitary Pipes(PVC)	Supreme / Prince / Kissan/ Finolex (with ISI mark) or Approved Equivalent (with test certificate)
2.03	Water supply pipes(CPVC)	Astral/ Ajay/ Ashirwad/ Finolex/ Plasto or Approved Equivalent (with test certificate)
2.04	Pumps of Required capacity/Horse power	Kirloskar/Crompton/ L&T/CRI or Approved Equivalent (with test certificate)
2.05	Septic Tank	Thermax / Ion Exchange/ Sunenviro or Approved Equivalent (with test certificate)
3.00	ELECTRICAL WORKS	
3.01	Transformers	Local EB approved
3.02	Switch Gears	ABB / L&T / Legrand or Approved Equivalent (with test certificate)
3.03	Cables and Wires	Polycab/Havells or Approved Equivalent
3.04	Switches and Sockets	Anchor /ABB or Approved Equivalent
3.05	External Lighting	Anchor/ Legrand / Wipro or Approved Equivalent

List of Approved Makes to be used for Project

S. No.	Description	Makes ¹¹
1	Tiles	
1a	White Glazed Tiles	RAK / Johnson / Somany / Kajaria or approved equivalent
1b	Vitrified tiles	RAK / Johnson / Somany / Kajaria or approved equivalent
1c	Granite tiles	RAK / Johnson / Somany / Kajaria or approved equivalent
2.	Flush doors and plywood products	As approved samples
3.	Steel doors & windows	TATA / SAIL Steel, Cuirass, or approved equivalent
4.	Rolling shutters & grills	TATA / SAIL Steel, or approved equivalent
5.	Aluminum door & window sections	Kalco / Milgard / ClimateGuard or approved equivalent
6.	Water proofing compounds	Dr.Fixit / Tikitar / Dubond or approved equivalent
7.	Paints & Distempers	Asian / Berger / Dulux or approved equivalent
8.	Red oxide	Berger / Asian Paint / Dulux or approved equivalent
9.	Water proofing cement paint	Dr. Fixit / Durabuild / Rainguard or approved equivalent
10.	Glass	Saint Gobain / Asahi / Modiguard or approved equivalent
11.	Pressed Steel Sections	Jindal / Kamdhenu or approved equivalent
12.	Reinforcing Steel	TATA / SAIL or approved equivalent
13.	Cement	(43,53 Grade) Ambuja / Ultratech / ACC or approved equivalent
14.	Structural Steel Sections	Jindal / Kamdhenu or approved equivalent
15.	Z Sections	Jindal / Kamdhenu or approved equivalent
16	Cup boards	Use best quality of marine ply or approved equivalent as directed by Project Manager/appropriate government authority appointed by GSCDL
17	Water Supply Pipes & its accessories	(Medium with high quality fibre with ISI Mark) Esco / Jaguar / Prince / Astral / Finolex / Supreme or approved equivalent
18	Lifts / Escalators	Schindler / Schneider / Omega / Otis / Hitachi / Mitsubishi or approved equivalent
19	CCTV Cameras and its allied accessories	Hikvision / CP Plus / Zicom / Sony / Samsung / AVTech / Bosch / LG or approved equivalent
20	Fire extinguishing systems	Omex / Lifeguard / Ceasefire / Agni or approved equivalent
21	Sanitary wares	Jaguar / Hindware / Simpolo / Cera or approved equivalent
22	Wire	(Fire Proof) Havells , Polycab. KEI Universal, Finolex or approved equivalent
23	Switches/Sockets	MK / Crabtree / Legrand or approved equivalent

Note: The above list is indicative but not exhaustive.

Other Facilities and considerations

- i. Lighting: The Contractor shall provide adequate lighting system.
- ii. Signages: Proper illuminated Sign in accordance with the codes and standards to be provided with the parking facility. The codes may be referred are NBC, IRC and local DCR. The scheme for signals shall be finalized in consultation with the Project manager/ appropriate government authority appointed by GSCDL.

¹¹ The GSCDL is the authority to provide a list of approved makes

- iii. Drainage: The facility shall have proper and adequate drainage provisions. No stagnation of water shall take place within the parking facility Area. Preferably, the drain shall lie in the parking driveway.
- iv. Employee Amenities: Adequate Worker Amenities area and facilities to be provided by the Contractor.
- v. Safety Structures: Proper and adequate Safety gears with instructions to be provided On Site for staff.
- vi. Fire Fighting: Proper and Industry Standard Fire-fighting equipments to be provided by the Contractor.
 - c) The Contractor will be responsible for all Clearance from Town Planning / Municipal Corporation & any other competent authority needs to be obtained for constructing the Social Housing for EWS and use of Building for the same including all necessary Environmental clearance from concerned authority.
 - d) The Contractor shall also obtain No objection Certificate from Fire Department shall be obtained after taking care of disaster management measures as per NBC-2016 pre/ post construction as the case may be.
 - e) Any other clearances from any other competent Authority for any item other necessary items are also contractor's responsibility. The following are applicable permits (the list is indicative but not exhaustive)
 - GSCDL
 - Fire Department
 - Environmental Clearances
 - State Pollution Board
 - Services Agencies / Road Owning Agencies
 - Traffic Police (for traffic management schemes during and after the construction)
 - Land/Drain owning agencies
 - Any other applicable permits
 - f) Prior to the commencement of any construction activity, the Contractor shall
 - finalize and furnish an project implementation plan for the Project (Construction Plan) in consultation with the Project manager/ appropriate government authority appointed by GSCDL. The Construction Plan shall, includedetailed schedule which shall specify all major milestones and should cover all stages and aspects of the project implementation including design and engineering, procurement of materials and equipment, installation, construction, testing, etc.
 - Manpower deployment plan, including the designation of Key Personnel for the management and supervision of all Project Activities. This would include the designation of suitably qualified and

experienced personnel for areas such as Contract Administration and Supervision, Construction Management, Traffic & Safety, Environmental Management, Plant & Equipment Maintenance, Procurement, Materials Management, Quality Control & Assurance, etc.

- A broad method statement for key items setting out methodology of construction, materials and construction equipment mobilization, utilization plans, broad output calculations and details of the quality assurance and quality control procedures.
 - Advise to GSCDL on the details of the utilities that are necessary to be shifted, including suggestions on the alternate routing, and the estimates of the costs associated with such shifting.
- g) All designs have to be submitted to the Project manager/ appropriate government authority appointed by GSCDL for approval and works are to be taken up after the receipt of respective approval by the Project manager/ appropriate government authority appointed by GSCDL.

Designing & Construction of Social Housing for EWS

The Social Housing for EWS is coming up in an area of 14083Sqm. of land. The proposed Social Housing for EWS will capitalise on the elevation difference available at the land and the road.

- xxx. Undertaking all geo technical investigations at the proposed site which includes but not limited to soil investigations, slope/ hill stability investigations etc. as the case may be.
- xxxi. Undertaking of Architectural, Structural, Mechanical- Electrical- Plumbing, Interior, fit outs landscaping design for the entire structure including hill stability/ soil stability measures to be taken up (if required). The existing trees have to be seamlessly integrated in the proposed structure.
- xxxii. Submission of the above designs for approval of the Project manager/ appropriate government authority appointed by GSCDL.
- xxxiii. Providing and construction of the Social Housing for EWS based on the approved designs as per the Sikkim PWD specifications.

The Social Housing for EWS can be a RCC structure and or composite with Pre-fabricated Steel and RCC with Hard Stone Flooring Material to take care of high footfall, at the same time easy to clean. Sufficient capacity power/electricity generators should be installed for use of all basic parking functions in case of power failure with proper chimney arrangements to disperse off smoke.

SPECIFICATIONS

The structure has to be designed in accordance with standard of specification of Sikkim PWD duly conforming to relevant IS Codes All designs have to be submitted to the Project Manager/appropriate government authority appointed by GSCDL for approval. Any item or part of the item not covered in Sikkim PWD Specifications shall be executed as per relevant IS Codes or CPWD Specifications or as per the directions of Authority. The following codes and standards will be applicable

- xxxiv. Sikkim PWD Specifications
- xxxv. Central PWD Specifications (CPWD)
- xxxvi. Bureau of Indian Standards (BIS)
- xxxvii. National Building Codes (NBC)
- xxxviii. Local Building Bye Laws and DCR
- xxxix. Indian Road Congress (IRC Codes)
 - xl. The Sikkim Allotment Of house sites and Construction of Building (Regulation and Control) Act, 1985
 - xli. Sikkim Building Construction Regulation amendment
 - xlii. Gangtok Stability Map

The design of facilities for the handicapped and the disabled people, like the toilets, bathrooms, ramps shall be designed as per the respective IS Codes and guidelines issued by Government of India or Government of Sikkim. These codes and specifications shall deem to be bound in this document. The technical specifications for Civil, Mechanical and Electrical installations works are detailed in the subsequent sections. Should there be any conflict between the codes and specifications or if any specifications aren't present, following order is to be followed for reference:

- xl.iii. Sikkim PWD
- xl.iv. CPWD
- xl.v. BIS CODE

2.1. Structural Requirement

The building shall be designed in accordance with the latest Indian Standard Codes and shall be designed to resist wind and seismic forces

- xlvi. RCC Structures shall be designed as per IS 456:2000
- xlvii. Steel Structures shall be designed in accordance with the provision of IS 531-1984 and IS 800:1984. Structural steel shall conform to IS 2062. Tubular section shall conform to IS 4923
- xlviii. Architectural design norms as per NBC (National Building Code – 2016) Structural Design norms as per NBC and BIS (Bureau of Indian Standards).

Contractor is advised to carry out its own tests and investigations related to soil condition, strata, bearing capacity and other characteristics

2.2. Material Specifications- Civil/ Building works

The Tenderer are expected to possess and be well conversant with the following Sikkim PWD Specifications. Any item or part of the item not covered in Sikkim PWD Specifications shall be executed on relevant BIS specification, IS standard and code of practice.

All items of works shall be executed as per Sikkim PWD Specifications. Any item or part of the item not covered in Sikkim PWD Specifications shall be executed on relevant BIS specification and CPWD Specification and relevant IS CODES for best quality of items referred or as per directions of Project Manager/appropriate government authority appointed by GSCDL. The brief specification of main materials involved and items to be executed are given below:

2.3. General (Excavation, Filling and Metaling)

This item refers to the clearing of site for construction of start, setting out of works, profiles, etc., excavation and filling of all open foundations, wet or dry, for the column and wall footings, trenches, pavements, inspection pits and basements, plinths, areas for levelling, drainage lines, water supply lines etc.

Installing refers to the aggregate, layer below floors, pavements, plinth protection etc.

Contractor shall refer schedule of rates of Sikkim PWD building works, including water supply and sanitary fittings which is referred to Local Approved by Government department, Sikkim PWD specifications 2018-19 including amendments as applicable.

2.4. Clearingthesiteandsettingoutofworks

The site on which the structure is to be built, as shown on the plan and the area required for setting out and other operations, shall be cleared of all obstructions, loose stones, materials and rubbish of all kinds, stumps, brush wood, shrubs and other growth, roots being entirely grubbed up without extra cost. The materials obtained will be the property of the owner and the materials pronounced useful by the Project Manager/appropriate government authority appointed by GSCDL. shall be conveyed and properly stacked as directed by the Project Manager/appropriate government authority appointed by GSCDL. All holes or hallow, whether originally existing or produced by the removal of loose stones or brushwood, shall be carefully filled up with earth, well rammed and levelled off up to the level of already filled or existing ground as directed.

Trees on the site shall not be cut unless authorized by the Project Manager/appropriate government authority appointed by GSCDL, shall not be damaged during construction. The above work of cleaning the site shall be reckoned to be included in the rate paid for various items and no extra shall be paid.

The contractor shall be responsible for the true and proper setting out of the works. He shall be responsible for proper maintenance of all reference pillars, bench marks, stakes and other evidences existing in the field required in connection with the setting out of works, at his own cost, till physical completion of all the items of the work or prior to that if agreed to by the Project Manager/appropriate government authority appointed by GSCDL.

The lines and levels of all structures shall be carefully set out and frequently checked, care being taken to ensure that correct gradients and levels are obtained everywhere. No earthwork or structural works shall be commenced until the center line has been referenced.

All such bench marks, reference pillars etc., established by the contractor shall be subject to check and approval of the Project Manager/appropriate government authority appointed by GSCDL. or his authorised representative at all times and the contractor shall ensure safe guarding all survey monuments, bench marks, beacons etc. Any variations noticed in the work as a result of improper establishment or maintenance of these shall be at the risk and expenses of the contractor.

2.5. Classification of soil for excavation purposes

All materials encountered in the excavation shall be classified as under:

- xlix. Soils shall include sand, gravel, clay, silt and other similar soft or loose materials and all materials of earthy or sandy nature, small size stone or gravel, soft and hard Moorum stiff clay etc., which can be ploughed or excavated by ordinary spade, pick, shovel etc., without restoring to barring, wedging and or blasting.
 - I. Soft laterite: shall include all rocks such as slate shale, laterite, conglomerates, all decomposed and weathered rock, highly fissured rock, old masonry, concrete foundation and pavements, which can be removed by barring, wedges, etc., but not by ordinary spade, pick, shovel etc.
 - li. Hard rock shall include all rock occurring in masses and boulders larger than 0.3 cum in volume which in the opinion of the Project Manager/appropriate government authority appointed by GSCDL. can be best be removed by blasting but on account of restriction to blasting at this site will have to be removed by cold chisels or wedges, line drilling or jack hammer. The decision of the Project Manager/appropriate government authority appointed by GSCDL regarding the classification of soil and rock shall be final and binding.

2.6. Excavation

- lii. Excavation shall include careful removal of all materials or whatever nature and whether dry or wet, necessary for the construction of work, exactly in accordance with lines, levels, grades and curves shown on the plans or as directed by the Project Manager/appropriate government authority appointed by GSCDL. It shall be taken to exact widths and levels of the lowest step of foundation/footing and the sides shall be left to plumb where the nature of the soil permits it. Any shoring, strutting and timbering or cutting of extra widths of trenches required for providing working space shall be done by the contractor, the same shall be deemed to have been included in the quoted rate. The contractor shall notify the Project Manager/appropriate government authority appointed by GSCDL. before starting excavation and take cross section levels (for purposes of measurements) jointly with the Project Manager/appropriate government authority appointed by GSCDL. before the ground is disturbed.
- liii. The bottom of the foundation shall be levelled both longitudinally and transversally or stepped as directed. Should any of the excavation be carried down to a level below the specified level, the contractor shall fill in such extra excavation at his own cost with M100 concrete, well rammed into position until it is brought up to the proper level, filling with excavation material not being permitted for this purpose.

- liv. Where such extra excavation is necessary due to removal of loose boulders, the extra excavation and concrete for filling shall be paid under relevant items of Bill of Quantities. The corners of the excavated pits shall be made true and square and all loose debris shall be removed to the satisfaction of the Project Manager/appropriate government authority appointed by GSCDL. Before any foundation concrete is placed, the Project Manager/appropriate government authority appointed by GSCDL shall inspect the foundation trenches. If any loose patches or pockets come to light on inspection, these shall be dug out as directed and filled and rammed with M100 concrete. Just before laying the foundation concrete all bottom of trenches shall be lightly watered and thoroughly rammed.
- lv. The contractor shall provide suitable drainage arrangements, to prevent surface water from any source entering the foundation pits, at his own cost.
- lvi. Any obstacle encountered during excavation shall be reported immediately to the Project Manager/appropriate government authority appointed by GSCDL and shall be dealt with as instructed by him. Removal of buried piping or cables shall not be done without prior permission of the Project Manager/appropriate government authority appointed by GSCDL and the contractor shall take all measures to protect such lines. Cost of such protective measures and deemed to be included in the rates for various items of excavation. No blasting shall be permitted for excavation of foundation even in rocky formation without the prior permission of the Project Manager/appropriate government authority appointed by GSCDL.
- lvii. The contractor shall not undertake any concreting in foundation until the excavation pits is approved by the Project Manager/appropriate government authority appointed by GSCDL.

2.7. Excavation below ground water table

For all foundations below ground water table, excavation shall be done first just up to ground water level and further excavation to founding level shall be done just before concreting. As soon as founding strata is reached, lean concrete mud mat shall be placed and concreting of foundation shall be carried out with minimum loss of time. During entire operation, excavation shall be kept dry by dewatering. CONTRACTOR shall programme his work to ensure that the above procedure is strictly followed.

2.7.1. Backfilling near structures

Backfill shall not be dropped directly upon or against structure/facility where there is a danger of displacement damage* Trucks or heavy equipment for depositing compacting backfill shall not be used within 1.5 m building of walls, piers or other facilities which may damage by their weights, or operation or method compaction. The method of depositing and compact backfill shall be approved by Project Manager/appropriate government authority appointed by GSCDL.

2.7.2. Excavation in hard rock scope

This specification covers general requirements of excavation in all types of hard rock as classified in specification "Earth work in grading, Excavation, Backfilling".

Unless otherwise stated herein, IS. Specification "IS-4081: Safety code for Blasting and related Drilling operations" shall be followed. After removal of overburden, if any, excavation shall be continued in rock to such widths, lengths, depths and profiles as are shown on the drawings or

such other lines and grades as may be specified by Project Manager/appropriate government authority appointed by GSCDL. As far as possible all blasting shall be completed prior to commencement of construction. At all stage of excavation, precautions shall be taken to preserve the rock below and beyond the lines specified for the excavation, in the soundest possible condition. The quantity and strength of explosive used, shall be such as will neither damage nor crack the rock outside the limits of excavation. All precautions, as directed by Project Manager/appropriate government authority appointed by GSCDL, shall be taken during the blasting operations and care shall be taken so that no damage is caused to the adjoining buildings or structures as a result of blasting operations. In case of damage to permanent or temporary structures, CONTRACTOR shall repair the same at his cost to the satisfaction of Project Manager/appropriate government authority appointed by GSCDL. As excavation approaches its final lines and levels, the depth of holes and amount of explosives used shall be progressively and suitably reduced, In this section wherever blasting is referred it means only controlled blasting.

Specific of Project Manager/appropriate government authority appointed by GSCDL. will have to be taken by CONTRACTOR for blasting rock and he shall also obtain a valid Blasting License from the authorities concerned. If permission for blasting is refused by Project Manager/appropriate government authority appointed by GSCDL., the rock shall be removed by wedging, barring, heating and quenching or other approved means. All loose or loosened rock in the Sides shall be removed by barring, wedging/etc. The unit rates for excavation in hard rock shall include the cost of all these operations.

When excavation has almost reached the desired level, hand trimming shall have to be done for dressing the surface to the desired level. Any rock excavation beyond and over break limit of 75mm shall be filled up as instructed by Project Manager/appropriate government authority appointed by GSCDL, with concrete of strength not less than M 10. The cost of filling such excess depth shall be borne by CONTRACTOR and the excavation carried out beyond limit specified above will not be paid for. Stepping in rock excavation shall be done by hand trimming.

2.7.3. Measurement

Volume of rock excavated shall be calculated on the basis of length, breadth and depth of excavation indicated on the drawings. No payment will be made for excavations/over break beyond payment line specified. Where such measurement is not possible as in the case of strata intermixed with soil, excavated rock shall be properly stacked as directed by Project Manager/appropriate government authority appointed by GSCDL. and the volume of rock calculated on the basis of stack measurements after making appropriate allowance for voids. The allowance to be made for voids shall be decided as per Sikkim PWD SR, it will not be a subject matter of dispute or appeal.

2.7.4. Shoring

- lviii. Any shoring, strutting and timbering required for protecting the sides of excavation and for ensuring the safety of workmen and equipment, shall not be paid for separately. The contractor shall be responsible for the design of the shoring which shall however be strong enough to resist side thrust and prevent slips, slow and damage to adjacent works and property. It shall be removed as directed after all the items of work, which it is required are completed.
- lix. Shoring shall include all labour, materials, erection of the poling boards, wales, ballies etc., keeping in position as required and dismantling and receiving the same after the work is over, as directed.

2.7.5. Dewatering

The rate quoted for excavation shall include bailing or pumping out all water which may accumulate in the excavation during the progress of the work either from seepage, rain or any other cause and diverting surface if any, by bund or other means. The bunds shall be removed after their purpose is served. Pumping out water from any foundation enclosure, basements or trenches shall be done generally in such a manner as to preclude the possibility of any damage to the foundation trenches, concrete or masonry or any adjacent structure. The excavation shall be kept free from water:

- ix. During inspection and measurement
- lxi. When placing of concrete or masonry is in progress and until they have come above the natural water level
- lxii. Till the Project Manager/appropriate government authority appointed by GSCDL. considers that the concrete or mortar have set and hardened sufficiently and
- lxiii. During back filling and consolidating

2.7.6. Protection and safety

Foundation pits and similar excavation, road blockades, obstruction etc. shall be adequately fenced and marked at night with red lights and a watchman keep in charge to avoid accidents. Adequate protective measures shall be taken to see that the foundation excavation does not affect or damage adjoining structures. All required measures shall be taken by the contractor, at his own cost to ensure safety of the excavation, the people working in or near the excavation and people and property in the vicinity. He shall be entirely responsible for any injury to life and a damage to property caused by his negligence or accident due to his constructional operations.

2.7.7. Stacking of excavated materials

All materials excavated from the foundation, of whatever kind they may be, shall be placed at a distance of more than 1.5m from the edge of the foundation or as directed by the Project Manager/appropriate government authority appointed by GSCDL. All excavated material will remain the property of the owner. Rate for excavation shall include the cost of sorting out of useful materials and stacking them separately or transporting them as directed. Material suitable for filling or other use shall be stacked in convenient places. Materials not useful in any way shall be disposed-off. The Project Manager/appropriate government authority appointed by GSCDL. shall be the final authority as to what is useful material. The site shall be left clean of all debris at the completion of the work. Notwithstanding the above, it may be noted that in this particular work, as there is no space to stack the excavated earth at site, the contractor has to convey the earth excavated to a place selected by him and arrange to stack there temporarily. The useful earth (which would be decided by the Project Manager/appropriate government authority appointed by GSCDL.) shall be brought back for refilling and the balance if any shall be disposed of by the contractor. All the expenses incurred in the above operation of transportation of earth to and fro will be borne by the contractor and the rates built in to the item No. (1) will be inclusive of all the above operations.

2.8. Backfilling around foundations in trenches and plinth

- lxiv. Back filling material shall be as approved by the Project Manager/appropriate government authority appointed by GSCDL. or as specified in drawing.

- lxv. Back filling or excavations in trenches around foundation and elsewhere shall consist of one of the following materials as the Project Manager/appropriate government authority appointed by GSCDL. may direct in each location.
 - a) Selected earth from excavated soil heap
 - b) Selected earth brought from borrow area
 - c) Sand filling
 - d) Lean concrete filling
- lxvi. Filling shall be done after the concrete or masonry in the foundation has fully set and its curing completed. It shall be done in such a manner as not to cause undue thrust on any part of the structure.
- lxvii. Back filling around completed foundations shall be done to the lines and levels shown on the drawings, including any trimming of the surfaces, as may be necessary. This will be done with selected and approved earth from excavation or otherwise with borrowed materials as directed by the Project Manager/appropriate government authority appointed by GSCDL. Where sufficient suitable material is not available from the excavation, The Project Manager/appropriate government authority appointed by GSCDL may direct to import suitable earth from different sources. The refilling shall be done in horizontal layers of thickness not exceeding 15cms from pocket with careful watering, ramming and rolling etc., to obtain necessary level of compaction.
- lxviii. The contractor shall not fill in and around any work, until it has been approved by the Project Manager/appropriate government authority appointed by GSCDL.
- lxix. Back filling around liquid retaining structures and piping shall be done only after testing of structures against leakage is done and approval of Project Manager/appropriate government authority appointed by GSCDL is taken

2.9. Metalling

- lxx. Graded coarse aggregate layer below floor, pavements and plinth protection
 - a. Graded coarse aggregate layer of thickness specified in the Bill of quantities as shown on the drawing shall be provided after the structural foundations and plinth constructions have been built and the filling in the plinth has been watered and thoroughly consolidated. Excavation for cable ducts, pits, trenches and pocket other than those for structural foundations and plinth shall be made only after the graded coarse aggregate layer is laid and consolidated
 - b. Materials: The aggregate to be of the quality as specified for concrete elsewhere. The size to be used are 50mm to 40mm, 40mm to 25mm and 25mm to 20mm.
 - c. Construction Procedure: The bed on which the graded coarse aggregate layer is to be laid shall be cleared of all loose materials levelled, watered and compacted and got approved by the Project manager/ appropriate government authority appointed by GSCDL before laying the aggregate layer.
- lxxi. The metal shall be mixed thoroughly in a proportion of 2 parts of 50mm metals, to 1 part each of 40mm and 25mm. The mixing shall be done before laying the same at site. It shall

be laid in 2 layers of 10cm thickness and each layer shall be consolidated to a thickness of 7.5cm by an 8T to 10T capacity roller. At places which have no access for mechanical rollers, hand rollers after obtaining permission from Project Manager/appropriate government authority appointed by GSCDL. While laying, rolling and consolidating, precautions shall be taken to ensure that no damage occurs to the masonry or any other portion of the structure. But special care shall be taken for compaction near masonry and concrete structures. Proper manual and vibratory tamping equipment shall be employed for satisfactory compaction in such area. Weak spots if any shall be rectified at contractors own cost. After the graded course aggregate has been thoroughly consolidated, Moorum to completely fill the interstices shall be sprayed gradually over the surface and dry rolling shall be done with Moorum for each layer. Finally, the surface shall be finished with a layer of Moorum moistened and rolled over so as to provide an even surface. The maximum thickness of the finished Moorum layer shall not exceed 12mm. The quoted rate shall include the cost of Moorum layer also.

2.10. Disposal of excavated earth

Surplus earth and soil, which are rejected for back filling shall be removed from construction area to the area demarcated by the Project Manager/appropriate government authority appointed by GSCDL. The materials shall be conveyed by suitable means including trucks, if necessary and disposed-off as directed by the Project Manager/appropriate government authority appointed by GSCDL, loading and unloading incidental to this transportation shall be included in the quoted rate.

2.11. Measurement and payment

lxxii. Payment for earthwork in excavations shall be made on cubic meter (m³) basis on the measurement of volume of pits/trench of excavated as per the approved for construction drawing. Quoted rates shall cover the following items also:

- h) Forming (or leaving) "dead men" or "Tel1 tales" in borrow pits and their removal after measurement
- i) Forming (or leaving) steps in sides of deep excavation and their removal after measurement
- j) Unless otherwise specified, removing slips and falls in excavation
- k) Excavation for insertion of planking and strutting
- l) Slings or supporting pipes, electric cables etc., met during excavation

lxxiii. The rate shall include pumping and bailing out rain water surface water accumulated in the excavated pit or trench, removal and disposal of surplus excavated soil from construction area. The rate shall also include cleaning of site, setting out and line out work required for the excavation. No separate payment will be made for watering and consolidating the bottom of excavations, stacking of excavated soils, shoring etc. The rate shall include the clearing of site of all the debris at the end of work and levelling the ground as directed for a distance of 5m around the works.

lxxiv. Dimensions of excavation shall be measured correct to 1 cm and individual quantities shall be calculated to a whole cubic Metre.

- lxxv. The payment for respective classes of excavation shall be based on quoted unit rate per cum.of accepted excavation, limited to dimensions shown in plans or as directed by the Project Manager/appropriate government authority appointed by GSCDL. Excavation to dimensions in excess of the above shall not be paid for.
- lxxvi. When excavation is to be done below ground level for foundations or plinth beams or other work, the area of plan in Sq.mtr. shall be evaluated for the maximum size of member or component as shown on drawings. This area shall be multiplied by the average depth to get the effective quantity in cubic Metre that would be considered for payment for excavation in the case under consideration.
- lxxvii. Contractor shall intimate the Project Manager/appropriate government authority appointed by GSCDL. as soon as different classifications of soils are met with.Joint levels shall be taken as to the levels of different soil classification and volumes shall worked out on the basis of levels only.Where walls of different strata cannot be clearly marked and defined, the contractor shall stack different soils of various classifications separately for measurement purpose and then dispose it off as directed.
- lxxviii. If soil of any classifications other than that specified is met with during excavation, the decision of the Project Manager/appropriate government authority appointed by GSCDL. as to the classification of soil, levels of the strata of different classifications and their locations shall be binding.
- lxxix. Driving of sounding bars or jumping small drill holes to expose the nature of substratum up to total length of 1.0 M (approximately) below the bed of excavation, distributed in 2 or 3 places in each foundation, if necessary, will be considered incidental work and will be paid for separately.

2.12. Backfilling

Paymentforback filling withexcavatedearth shallbebased onvolumeof consolidated fill. Thisvolumeshall bederived from thedifference between the volumeofexcavation andthe structureof trenchesasthe case maybe. Therateshallincludecostofextractingsuitableapprovedearthfromexcavatedsoil,carriageuptodirected locations,placing watering, compactinginlayers,trimming and dressing, finished surfaceand disposal ofsurplus material.

However,back filling done withother borrowed materials shall be paid separately. Thecostshall include the cost of material,requiredlabourforloading, unloading the material transporting ittothe site and backfilling etc.,asperspecifications above. Measurementsshall be based on volume ofconsolidatedfill.

2.13. Metalling

Thepaymentforvariousthicknessof gradedcoarseaggregate layer shallbemade onthe basisofunitrate persq.Meterinplanofthelayerinpositionlimitedhowevertothe dimensionsindicatedinplanor asdirected by theProject Manager/appropriate government authority appointed by GSCDL. Quoted rate forgraded coarseaggregate layershall includefor consolidatingthe layers and surface finishing with Moorumlayer not more than12 mmthick and all other incidental workrequiredto complete the item as per these specifications.

2.14. Disposal

Payment shall be made on Cubic Meter basis on the difference of measurements of the volumes of the excavated pits and the measurements of the back filling. Quantity generated due to voids in back filled volume of earth shall also be removed by the contractor at no extra cost and this disposal of earth shall not be measured and paid under any item.

In exceptional circumstances the Project Manager/appropriate government authority appointed by GSCDL. may direct the contractor to remove surplus earth, concrete debris or any other waste material from site to the areas of disposal on the basis of truck measurement. In such cases volume of material shall be calculated on the basis of truck volume reduced by 30% for voids for earth and 20% for Moorum. All other provisions of disposal such as spreading, levelling grading shall apply in this case also.

The lead shall be measured along with shortest permissible route of movement. No positive or negative lift will be measured and paid for.

2.15. Termite Treatment:

Providing and injecting chemical emulsion for pre - constructional ant termite treatment as per I.S.6313. (Part – I & Part – II) specification and creating a chemical barrier in bottom and sides of foundation trenches, top- surface of plinth filling junction of walls and floors along with external perimeter of the building expansion joints surrounding the pipes and cables etc. complete using approved quality of chemical emulsion of requisite quantity prescribed by the manufacturer as directed by the Project Manager/appropriate government authority appointed by GSCDL including cost of all materials and labour taxes etc. complete. (indemnity bond for warranty for 10 years to be furnished)

CONCRETE WORKS

General

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

Concreting: In order to achieve accuracy in the proportion of batching, batching plant should be installed and maintained at the site for the concreting work or Ready-mix concrete shall be procured on prior approval of as per directions of Project Manager/appropriate government authority appointed by GSCDL. Vibrator to be used for concreting purposes should be conforming to I.S. 7246. Cement Concrete in foundation shall be with conformity to I.S.2571

Relevant Codes and Specifications

The following specifications, standards and codes are made apart of this specifications. All standards, specifications, codes of practice referred herein shall be the latest editions including all applicable official amendments and revisions.

In case of discrepancy between this specification and those referred to herein, this specification shall govern.

Materials

I.S.CODE

- lxxx. IS 269 – Specification for ordinary, rapid hardening and low heat and Portland cement.
- lxxxi. IS-455 – Specification for Portland blast furnace slag cement.
- lxxxii. IS-1489 – Specification for Portland pozzolana cement.
- lxxxiii. IS-4031 – Method of Physical tests for Portland cement.
- lxxxiv. IS-650 – Specification for standard sand for testing of cement.
- lxxxv. IS-383 – Specification for coarse and fine aggregates from natural sources for concrete.
- lxxxvi. IS-516 – Method of test for strength of concrete.
- lxxxvii. IS-1199 – Method of sampling and analysis of concrete.
- lxxxviii. IS-432 – Specification for mild steel and medium (Part I & II) tensile steel bars and hard drawn steel wire for concrete reinforcement.
- lxxxix. IS-1139 – Specification for hot rolled mild steel and medium tensile steel deformed bars for concrete reinforcement.
 - xc. IS-1566 – Specification for plain hard drawn steel wire fabric for concrete reinforcement.
 - xc. IS-1786 – Specification for high tensile steel bars for concrete reinforcement.
 - xcii. IS-2090 – Specification for high tensile steel bars used in prestressed concrete.
 - xciii. IS-4990 – Specification for plywood for concrete shuttering work.
 - xciv. IS-2645 – Specification for integral cement water proofing compound.

- xcv. IS-6925 & IS 903 – Specifications for admixtures.
- xcvi. IS-8112 – Specification for 43 grade cement.

Equipment

I.S. CODE:

- xcvii. IS-1791– Specification for batch type concrete mixer.
- xcviii. IS-2438– Specification for Roller Pan mixer.
- xcix. IS-2505– Specification for concrete vibrators immersion type.
 - c. IS-2506– Specification for screed board concrete vibrator.
 - ci. IS-2514– Specification for concrete vibrating tables.
 - cii. IS-3366– Specification for pan vibrators.
 - ciii. IS-4656– Specification for form vibrators for concrete.
- civ. IS-2722– Specification for portable swing weigh batchers for concrete (single and double buckets types).
- cv. IS-2750– Specification for steel scaffolding.

Code Of Practice

I.S. CODE:

- cvi. IS-456 – Code of practice for plain and reinforced concrete.
- cvii. IS-1343 – Code of practice for prestressed concrete.
- cviii. IS-3370 – Code of practice for concrete structures (Parts I to IV) for storage of liquids.
- cix. IS-3935 – Code of practice for composite construction.
- cx. IS-3201 – Criteria for design and construction of precast concrete trusses.
- cxii. IS-2204 – Code of practice for construction of reinforced concrete shell roof.
- cxiii. IS-2210 – Criteria for the design of RC shell structures and folded plates.
- cxiii. IS-2751 – Code of practice for welding of mild steel bars used for reinforced concrete construction.
- cxiv. IS-2502 – Code of practice for bending and fixing of bars for concrete reinforcement.
- cxv. IS-3414 – Code of practice for design and installation of joints in buildings.
- cxvi. IS-3558 – Code of practice for use of immersion vibrators for consolidating concrete.
- cxvii. IS-4014 – Code of practice for steel tubular scaffolding (Part I & II)
- cxviii. IS-2571 – Code of practice for laying insitu cement concrete flooring.
- cxix. IS-10262 – Code of practice for mix design.
- cxx. SP-23 – Hand book for concrete mix design.

Measurement

I.S. CODE:

- cxxi. IS-1200 – Method of measurement of building works.
- cxxii. IS-3385 – Code of practice for measurement of civil engineering Works.

Construction Safety

I.S. CODE:

cxxiii. IS-3696 – Safety code for scaffolding and ladders (Part I & II)

Materials

All materials shall be obtained from sources approved by the Project manager/ appropriate government authority appointed by GSCDL. The agreed source or quality of any materials shall not be changed during the course of the contract except with the approval of the Consultants.

When requested by the Consultants, the Contractor shall provide a certificate from the manufacturer, for each and every delivery of material, showing the source, quantity delivered and confirming that the material has been tested and conforms to the required Indian Standard.

Testing Of Concrete Materials

Prior to the commencement of concrete work, the Contractor shall get all cement, aggregates and water tested in the laboratories approved by the Project manager/ appropriate government authority appointed by GSCDL and shall keep approved samples in the site office for inspection of the Project manager/ appropriate government authority appointed by GSCDL at any time of the concreting operation.

Inspection and Testing of Materials

- cxxiv. The Contractor shall be required, if requested to produce the manufacturers' test certificate for the particular batch of materials supplied by him and all materials to be used by him on site shall confirm to specifications mentioned in the tender or as directed by Project Manager/appropriate government authority appointed by GSCDL. The test carried out shall be as per the relevant Indian Standards.
- cxxv. All tests required for designing (e.g. : hill side stability test, soil bearing test, other such relevant tests required) the structure to be carried out by Contractor as per specifications mentioned in the tender or as directed by Project Manager/appropriate government authority appointed by GSCDL. The test carried out shall be as per the relevant Indian Standards. The Contractor shall be required to produce all such certificates, if requested.
- cxxvi. Laboratory for testing fineness, consistency, setting time compressive & tensile strength of cement compressive & flexural strength of cement concrete and proof stress, elongation, tensile strength, bending & re-bending of reinforcement steel. Fully equipped field level laboratory for testing of general materials located at project site or at authority approved nearby place.

Table 2: Description of Test, Reference / Standards and Sample Quantity

S. No.	Description of Test	Reference / Standard	Quantity of Samples Required
Aggregates (Coarse & Fine)			
1	Sieve analysis (dry)/ fineness modulus	IS 2386 : Part I – 1963, IS 383 – 1970, MORTH – 4th Revision, 2001	20 kg
2	Silt content		2 kg
3	Specific gravity	IS 2386 : Part III – 1963	1 kg
4	Impact test	IS 2386 : Part III – 1963, MORTH – 4th Revision 2001	10 kg
5	Crushing Values / 10% fine value		10 kg
6	Los Angeles abrasion value		10 kg

S. No.	Description of Test	Reference / Standard	Quantity of Samples Required
7	Water absorption	IS 2386 : Part III – 1963, MORTH – 4thRevision 2001	1 kg
8	Flakiness index	IS 2386 : Part I – 1963, MORTH – 4thRevision 2001	10 kg
9	Elongation index		10 kg
10	Combined flakiness & elongation index		20 kg
Cement			
11	Cement (initial & final setting time, compressive strength)	IS 269, IS 8112, IS 12269	7 kg
Bricks			
12	Bricks (Set of Ten) (compression test, absorption test)	IS 1077-1986	10 nos.
Steel			
13	Steel bars (6 mm dia. to 20mm dia.) (Area on weight basis. Yield Stress/0.02% Proof Stress, Ultimate Tensile Strength, % Elongation)	IS 432 – 1986 IS 1786 – 2008	60 cm
14	Steel bars (above 20 mm dia.) (area on weight basis, yield stress / 0.02 % Proof stress, ultimate tensile strength, % elongation)	IS 432 – 1986 IS 1786 – 2008	60 cm
Concrete			
15	Concrete cube (compressive strength)	IS 456-2000, IS 516 – 1959	3 nos.
16	Concrete beam (Flexure test) (10x10x50 cm)	IS 456-2000, IS 516 – 1959	3 nos.
17	Concrete beam (Flexure test) (15x15x70 cm)		3 nos.
Tiles			
18	Tile (Absorption test)	IS 1237-1980, IS 13801 – 1993	6 nos.
19	Tiles (Wet transverse strength test)	IS 1237-1980, IS 13801 – 1993	6 nos.
20	Tile (abrasion test)	IS 13630 Part 12-1993	As decided by Project Manager/appropriate government authority appointed by GSCDL
Wood			
21	Wood (Moisture content)	IS 287 – 1993(Reaffirmed 1998) IS 11215-1991	As decided by Project Manager/appropriate government authority appointed by GSCDL
Cores			
22	CC Road core (Compression test)	IS 456-2000, IS 516 - 1959	
RCC Covers			

S. No.	Description of Test	Reference / Standard	Quantity of Samples Required
23	RCC Cover & Dhapa testing	IS 12592 : Part I, 1998	
24	RCC Pipes (Hume pipes)		
25	Hume pipe testing	IS 3597 – 1998(Reaffirmed 2001), IS 458 -1988	Minimum one pipe of each dia per lot
26	Up to 600 dia		
27	600 to 900 mm dia		
28	900 mm and above		
Concrete Paving Blocks			
29	Paver blocks (as per road department requirement)		
30	Compressive test		Up to 3 nos.
31	Water absorption test	BS 6717 – 1993	Up to 3 nos.
32	c) Flexure test	ASTMC936 IS 1237	Up to 3 nos.
33	d) tensile splitting test	BS6717-2001	Up to 3 nos.
34	Paver blocks (as per road dept. requirement)	IS – 15658-2006	3 Nos.
35	Compressive test		8 Nos.
36	Water absorption		8 Nos.
37	Flexure test		8 Nos.
38	Tensile splitting test		8 Nos.
39	Abrasion test (dry condition)		As decided by Project Manager/appropriate government authority appointed by GSCDL

In addition to above IS codes for tests to be carried all equipments shall be made available to site testing laboratory required for testing all materials used at site or during construction works and as directed by Project Manager/appropriate government authority appointed by GSCDL.

cxxvii. For examination and testing of materials and works at the site the Contractor shall provide all testing and gauging equipment necessary but not limited to the following:

- m) Theodolite
- n) Dumpy level
- o) Steel tapes
- p) Weighing machine
- q) Plumb bob, Spirit levels, Hammers
- r) Micrometers
- s) Thermometers, Stoves
- t) Hydraulic test machine
- u) Smoke test machine

cxxviii. All such equipment shall be tested for calibration at any approved laboratory, if required by the Project Manager/appropriate government authority appointed by GSCDL.

cxxix. All testing equipment shall be preferably located in special room meant for the purpose.

During construction also, the materials shall be sampled and tested as often as deemed necessary by the Project manager/ appropriate government authority appointed by GSCDL.. Samples shall

be taken and tested in accordance with the latest revisions of relevant Indian Standard Specifications and the cost thereof shall be borne by the Contractor.

Cement

The cement used throughout the work shall be to the approval of the Project Manager/appropriate government authority appointed by GSCDL. A certificate shall be obtained from the manufacturers and produced to the Consultants for each delivery of cement and in case of Ordinary Portland Cement it shall comply with the requirements of IS: 269 and IS: 8112. The Contractor shall store the cement in shed to be provided by him for this purpose at site. The Cement shall be delivered to the site in bags sealed with the manufacturer's seal and different types of cement shall be stored separately. The storage shed with watertight walls and roof, shall be maintained in a perfectly dry and well ventilated condition, 30 cm above ground level and the cement shall be stored as per instructions issued in the booklet of the Associated Cement Company. It shall be returned over from the bottom as and when required by the Project manager/ appropriate government authority appointed by GSCDL. Any cement which has been deteriorated, caked or which has been damaged due to any reason whatsoever shall not be used. No cement shall be used for the work that has been stored at site for more than three months unless it is retested. Test samples of cement may be drawn from each consignment as delivered and tested by the Contractor. Should the result of such test show that any sample does not comply with the specified requirement, the whole consignment from which the sample was taken, shall be rejected and forthwith removed entirely from the site and replaced with cement of satisfactory quality. The cement obtained from either L & T/ACC/Birla or approved equivalent shall be used on work.:

Ordinary Portland Cement (OPC) 43/53 grade Conforming to latest Sikkim PWD Building Works Specifications and IS 8112- 2013/12269-2013/ I.S. 269/455 shall be allowed for concreting in both plain & R.C.C. works. In no case Portland Pozzolonic cement shall be allowed for such work. In case of non-availability of O.P.C. Cement Portland Pozzolonic cement, conforming to relevant IS specification of the same popular brands shall be permitted for masonry work in foundations and superstructure with the permission of the Project Manager/appropriate government authority appointed by GSCDL. Cement shall be stored and stacked at the site of work according to Sikkim PWD norms. In no case, the cement shall be procured for requirement beyond 3 months and the same shall also be consumed within three months' time. All such cements, which shall be having storing age more than three months or otherwise appeared to be deteriorated, shall be got retested for compressive strength and initial and final setting time, before use. Decision for approved equivalent use or no use of such cements for works other than concreting shall be taken by the as per directions of Project Manager/appropriate government authority appointed by GSCDL and shall be final and binding.

Sand

Sand to be used for concrete shall be well graded mixture from coarse to fine grains, comply with the requirements of IS 383 and 515. It shall be clean, hard and free from salt, earth, clay and other impurities. Fine sand of uniform size or silt shall not be used. It will comply with sieve analysis in accordance with IS: 2386 Part II. Unless initially clean, all sand shall be thoroughly and carefully cleaned by screening and washing in fresh and clean water. The screened and washed sand shall not contain more than 8% by volume of clay, dust and silt immediately after allowing it to settle for 3 hours in water.

FM of sand shall neither be less than 2.2 nor more than 3.2 IS-383, I.S. 515.

Field tests shall be carried out regularly to ensure the suitability of sand.

Sample loads shall be available at site for the inspection of the Consultants and if approved by them all sand in the work shall be of similar quality. In case of sand containing moisture the proportions of concrete materials shall be adjusted to give the correct mixture.

It shall be free from harmful impurities and deleterious substances. In case fine dust and silt is found more than 4% the same shall be washed thoroughly before use.

Sand for Plastering and Mortars

For plain and reinforced cement concrete (PCC and RCC) or prestressed concrete (PSC) works, fine aggregate shall consist of clean, hard, strong and durable pieces of crushed stone, crushed gravel, or a suitable combination of natural sand, crushed stone or gravel. 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. Motorized 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, I.S. 2116 and test for conformity shall be carried out as per IS: 2386 (Part I to VIII). The Contractor shall submit for the approval of Project Manager/appropriate government authority appointed by GSCDL 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.

Coarse Aggregate

The coarse aggregate for the reinforced concrete work shall consist of crushed gravel, black trap, granite or other stone to the approval of the Consultants and shall be free from dust. If considered necessary by the Consultants, the aggregates shall be washed specially until an approved cleanliness is obtained. The use of laminated stone, flat or flaky material will not be permitted. The combined coarse aggregates shall in all respects be so graded as to allow 95% to 100% by weight to pass a 20mm IS sieve; 25% to 55% by weight to pass a 10mm IS sieve and 0% to 10% by weight to pass a 5mm IS sieve. The aggregates of different sizes shall be stored in separate stacks in clean state and free from all dirt.

The coarse aggregate where absorption of water after 24 hours' immersion is more than 5% by weight shall not be used.

When required by the Project Manager/appropriate government authority appointed by GSCDL tests indicated in IS 383 shall be carried out by Contractor at this cost to show the acceptability of the materials. Strong piles of aggregates shall have good drainage, preclude inclusion of foreign matter and preserve the gradation.

Unless, otherwise specified or ordered, only 3/4 " (20 mm) nominal size crushed aggregate shall be used as coarse aggregate for concreting purpose in slabs, beams, columns, in superstructure and foundations as per IS: 383-1970, IS : 515. The same size aggregate shall be used for conglomerate floors also. In lintels and slabs having thickness less than 12 cm, 12.5 mm nominal size crushed aggregate shall be used. Crushed aggregate shall not be having aggregate impact value more than 30 and water absorption more than 2%.

Water

Water used for all purposes in this contract shall be free from oil, acid, vegetable matter, salts or dirt of any kind which will have adverse effect on cement or steel in the case of reinforced concrete. Whenever called for the Contractor shall produce test results for water being used on work.

Average 28 days' compressive strength of at least three 15 cm concrete cubes prepared with water proposed to be used shall not be less than 90% of the average strength of three similar concrete cubes prepared with distilled water. Sea water shall not be used.

Water for mixing and curing shall be clean, free from injurious amount of oil, salt, acid, vegetable materials and other substances and harmful to concrete in conformity to I.S. 456 and I.S. 2025. Water for all purposes of preparing, mortars, concrete and curing of masonry and concrete works in construction shall conform to Sikkim PWD Specifications shall be procured on prior approval of as per directions of Project Manager/appropriate government authority appointed by GSCDL.

Admixtures

Plasticizers may be used in the concrete work to achieve better workability admixtures or cements containing additives (such as accelerators, retarders, water proofing agents etc.) shall not be used unless specified or otherwise directed or approved by the Project manager/ appropriate government authority appointed by GSCDL.

Steel Reinforcement

The following types of reinforcement shall be used.

- cxxx. Mild steel round bars conforming to IS: 432 (Part-I)
- cxxxi. Hot-rolled deformed bars conforming to IS: 1139
- cxxxii. Cold-twisted bars conforming to IS: 1786

The contractor shall produce a test certificate of the manufacturer for each consignment. Bars up to 25 mm diameters shall stand bending cold to an angle 180 Deg. round diameter equal to that of the test piece without fracture of the outside skin of the bent portion. If independent tests are considered necessary, they shall be carried out to IS: 223. No bar shall be more than 2 1/2% over or under the area as specified. Immediately before deposition of the concrete, reinforcements shall be well cleaned and made perfectly free from dirt, loose, rust, scales, paint, oil wash, grease or any other coatings which may destroy or reduce bond.

- cxxxiii. Steel Reinforcement:

High yield strength deformed bar TMT (HYSD TMT) having minimum strength of 415 N/ mm² up to and including 25 mm diameter and 500 N/mm² for bigger diameter conforming to IS: 1786 shall be used as reinforcement for RCC works. Binding wire shall be conforming to IS: 432/ I.S. 1786 of 2008. All steel shall be sound and free from cracks surface flaws laminations, rough and imperfect edges and all other defects. The variation in weight per meter length of the bars shall be permitted only up to the following limits:

- 6 mm & 8mm +7%
- 10 mm & 12 mm +4%
- 16 mm & above +3%

Spacer blocks shall be made conforming to M15 concrete tied with binding wires as specified or PVC spacer shall be used prior approval of Project Manager/appropriate government authority appointed by GSCDL.

Binding Wire shall conform to standards I.S. 280 (galvanized minimum 1 mm)

- cxxxiv. Structural steel:

General requirements relating a supply of structural steel shall conform to IS 8910. Requirements for mild steel (standard quality) plate, sections bars etc., designated as E250 (Fe 410-W) for use in structural work (as per IS:2062-2006, superseding IS 1977, 8500). Structural steel such as angle section, T-sections, I-sections, Channels & steel plates shall be conforming to IS: 226. Structural steel used in the works other than steel in reinforced concrete, rails and fastenings shall be either of the following type:

- v) Mild steel conforming to IS: 226 - "Structural Steel (Standard quality)" or IS: 2062 - "Structural Steel (fusion welding quality)
- w) Whenever high tensile steel is specified it shall be conforming to IS: 961 - "Structural steel (High Tensile)".

All steel tubes shall be hot finished seamless steel tubes (HFS) of the specified strength and shall conform to IS: 1161. Tubes made by other processes and which have been subjected to cold working, shall be regarded as hot finished if they have been subsequently been heat treated and are supplied in the normalized condition

Fabrication and Placement of Reinforcement

All steel reinforcement shall be fabricated and fixed in accordance with IS 2502. Bars shall be firmly bound together with annealed steel wire not thinner than 16 SWG at sufficient intersections to ensure that the network of rods will retain its original form and the mesh will be so temporarily supported as to retain its correct position in the formwork during the process of depositing the concrete. An adequate number of MS chairs and spacer bars shall be used in order to ensure accurate positioning of reinforcement. All splices and lengths of overlaps in reinforcement shall be strictly in accordance with the drawings. The overlaps shall be staggered, and their positions shall be approved by the Project manager/ appropriate government authority appointed by GSCDL. No welding of reinforcement is permitted unless approved by the Project manager/ appropriate government authority appointed by GSCDL in writing. The ends of wire ties must not project towards the face of the concrete, and all ends shall be cut off for bent inwards so that there is no risk of rust staining the surface of concrete. Offcuts of binding wire must be removed from the inside of forms after the steel fixing operations are over.

Where reinforcement bars are bent at construction joints and afterwards bent back into their original positions, care shall be taken to ensure that at no time is the radius of the bend less than 4 bar diameters for deformed bars. Care shall also be taken when bending back bars, to ensure that the concrete around the bar is not damaged.

Where reinforcing bars are lapped with dowels provided in concrete work: If the lap length to provide in concrete work is less than the minimum lap length specified on the drawings for development of full strength of the connection, bars shall be spliced by welding. Such weldings shall conform in all respects to the provisions given in Appendix 'A' of SP:34(S&T)-1987, Handbook on concrete reinforcement and detailing, Bureau of Indian Standards. Such splice shall be payable under relevant item of the Bill of Quantities. However, if the contractor has failed to provide sufficient lap length as shown on the drawing through his own fault, the bars shall be spliced by welding and such welded splice shall not be payable.

Spacer Blocks

To maintain the specified amount of concrete cover to the reinforcement, small precast concrete blocks of grades similar to that of concrete to be placed shall be used.

- cxxxv. At each end of reinforcing bar, not less than 25mm, nor less than twice the diameter of bar.
- cxxxvi. For longitudinal reinforcing bar in a beam, not less than 25mm, nor less than the diameter of the bar.
- cxxxvii. For longitudinal reinforcing bar in a column, not less than 40mm nor less than the diameter of the bar.
- cxxxviii. For tensile, compressive, shear or other reinforcement in a slab, not less than 15mm, nor less than the diameter of the bar.
- cxxxix. For vertical or horizontal reinforcement in concrete walls not less than 15mm nor less than the diameter of the bar.
- cxl. For reinforcement in footings, pile caps and raft foundations not less than 50mm.

Prevention of Rust Staining

Reinforcement left projecting above a concrete surface shall be cement washed if exposed in such a way that rust staining of concrete surfaces is likely. Any rust staining of exposed surfaces shall be cleaned immediately.

Storage and Handling of Reinforcement

Reinforcement shall be stacked off the ground in clean conditions and protected from contamination and excessive rusting. The reinforcement shall be clean and free from oil, grease, loose rust, loose mill scale, salt and chemical contaminants at the time of fixing in position and concreting.

Proportion for Concrete

The Contractor shall design concrete mixes to produce concrete of the required strengths. The contractor must submit full design of the mixes for approval of the Project manager/ appropriate government authority appointed by GSCDL and trial mixes will be prepared by the contractor in the presence of the Project manager/ appropriate government authority appointed by GSCDL, having workability, strength, minimum cement content and finish as criteria.

Concrete surfaces, which are to be finished with cement rendering shall be thoroughly hacked with approved hand tools immediately after removal of formwork so as to bring about adequate bond between the concrete and cement rendering.

Notwithstanding the acceptance by the Project manager/ appropriate government authority appointed by GSCDL of any mix design and series of trial mixes, variations may be made to the proportions when considered necessary by the Project manager/ appropriate government authority appointed by GSCDL. Such variations may be made to Nominal mixes if used, but variations of this nature will not be allowed to affect the unit price of concrete.

For both Nominal as well as Design Mix concrete, the quantity of cement shall be determined by weight. Where standard bags of cement are used, their weight shall be checked at frequent intervals and any loss in weight due to leakage etc. shall be made good.

In the case of Nominal Mix Concrete, aggregates shall be measured by volume, cement by weight and mixing water in graduated liter cans. In the case of controlled concrete all aggregates, and cement shall be measured

d by weight in approved weigh batching equipment. Mixing water shall be measured in graduated liter Cans.

While calculating the amount of mixing water, the moisture content of the aggregate shall be considered. The grades of concrete shall be in accordance with Table below.

Grade of Concrete	Minimum Compressive strength N/mm ²		
	At 7 days	At 28 days	Remarks
M 15	10	15	--
M 20	13.5	20	--
M 25	17	25	--
M 30	20	30	--

The above specified compressive strengths shall be for the use of ordinary Portland Cement in concrete. When rapid hardening Portland Cement is used, the 28 days' compressive strength requirements specified in Table shall be met at 7 days. Where other cements are used, the Project manager/ appropriate government authority appointed by GSCDL shall specify the corresponding requirements preferably on the basis of preliminary tests.

In order to get a relatively quicker idea of the quality of concrete compressive strength tests at 7 days may be carried out in addition to 28 days' compressive strength tests and it shall not be less than 67% of the 28 days Cube Strength. In all cases 28 days' compressive strength shall alone be the criterion for acceptance or rejection of the concrete.

Design

Mix Concrete is preferred to Nominal mix. If Design mix concrete cannot be used for any reason on the work for grades of M20 or lower, nominal mixes may be used with the permission of the Project Manager/ appropriate government authority appointed by GSCDL.

If Nominal Mix concrete does not yield the specified strength, such concrete shall be classified as belonging to the appropriate lower grade. Nominal Mix concrete proportion for a given grade shall not, nowhere, be placed in higher grade on the ground that the test strengths are higher than the minimum specified. As long as the quality of the materials does not change, a mix design earlier in use may be considered for later work.

The proportion of fine aggregate to coarse aggregate in Nominal Mix is generally 1:2 but subject to an upper limit of 1:1 1/2 and lower limit 1:2 1/2 depending upon the nature of aggregates. The cement content of the mix for any Nominal Mix shall be proportionately increased if the quantity of water in a mix has to be increased to overcome the difficulties of placement and compaction so that water cement ratio is not exceeded.

To improve

workability of concrete and cement, grout admixtures conforming to IS 6925 and IS 9103 could be permitted subject to the approval of Architects/ Project manager/ appropriate government authority appointed by GSCDL. Mixtures generating hydrogen, nitrogen etc., should not be used. Nothing extra will however be paid for the same.

Mixing of Concrete and Placing by Pumping/Pneumatic Placers

Mixing of concrete shall continue until there is a uniform distribution of material and the concrete is uniform in color and consistency and shall be for at least two minutes.

Mixers and weigh batches shall be maintained in first class condition throughout the contract and any mixer or plant which is faulty shall not be used. The drum on all mixers shall revolve at the speed recommended by the manufacturer. A mixer of any type which has been out of use for more than 20 minutes shall be thoroughly cleaned out before any fresh concrete is mixed. The subsequent 1st batch shall have additional cement to allow for sticking in the drum. All equipment's shall be maintained in a clean, serviceable condition and their accuracy periodically checked. All controlled mix of concrete shall be from RMC plants, which are duly approved.

Concrete may be conveyed and placed by mechanically operated equipment's., pumps or pneumatic placers only with the written permission of the Project Manager/appropriate government authority appointed by GSCDL.

Compressive Strength

The Contractor shall keep on site minimum six standard 15 cm test cube moulds and ancillary equipment for preparing test cubes. Before the Contractor commences any concrete construction, he shall make six cubes of mix concrete with the cement, sand, aggregate and water which he proposes using on the contract and shall have them tested at a Laboratory approved by the client and Project manager/ appropriate government authority appointed by GSCDL. Three cubes shall be tested at 7 days and three cubes at 28 days after casting and curing but shall not be limited to six cubes, but additional cubes have to be cast as per IS 456-2000, for 7-day strength and 28-day strength separately. In all cases the cubes shall give the minimum compressive strength for Preliminary Tests specified above. No concrete construction shall be commenced until Preliminary Tests on the six cubes referred above have been completed and result show the concrete to have the minimum compressive strength.

As construction proceeds samples from fresh concrete shall be taken as per IS: 1199 and cubes shall be made, cured and tested in accordance with IS: 516. Three test specimens shall be made for each sample for testing at 28 days. Additional cubes may be required for various purposes as to determine the strength of concrete at 7 days or at the time of striking formwork, or to determine the duration of curing, or to check the testing error. The test strength of the samples shall be the average of the strength of three specimens. The individual variations should not be more than + or - 15 percent of the average. If more the results of the sample are invalid any part of the work from which the cubes fail to give the required minimum compressive strength shall be dealt with the Contractor as directed by the Project Manager/appropriate government authority appointed by GSCDL and at the expenses of the contractor.

Design Mix Concrete

All design mix concrete shall be designed on the basis of preliminary tests. The contractor shall make trial mixes using samples of aggregates and cement typical of those to be used in the works. If possible, the concreting plant and the methods of transporting and depositing the concrete to be employed in the work shall be used to working conditions with the trial mixes.

All these preliminary tests approvals etc., shall be got done well in advance by the contractor before any concreting is contemplated. Failure on the part of the contractor to do so and the consequent delay in the completion of the works will not entitle him for any compensation whatsoever, either financially, or by way of extension of time.

Based upon the successful preliminary crushing and workability tests, the contractor shall submit mix design proposals to the Project Manager/appropriate government authority appointed by GSCDL, who will have the right to reject any trial mix not deemed satisfactory. The design mix shall be done for the Ready mix concrete of all the grades, as well as of the batching mixing separately through a certified agency. The Design is to be got approved by the Project manager/ appropriate government authority appointed by GSCDL before execution.

It shall be the ultimate responsibility of the contractor for selection of the trial mix to the complete satisfaction of the Project Manager/appropriate government authority appointed by GSCDL.

Cement Content, Water Cement Ratio and Workability

From durability consideration, strict control on the cement content and water ratio and in the process of concrete making, laying, compaction and curing must be exercised, the aim being to achieve a dense and impermeable concrete.

The following limit in respect of cement content and water cement ratios shall be maintained:

Structural Member size of aggregate)	Minimum cement content in kg/m ³ (for 20mm nominal	maximum water cement ratio
a) PCC members	-	0.45
b) RCC members	-	0.40
c) PSC members	-	0.40

The cement content shall be as low as possible but not less than the quantities as specified as above.

The concrete is also liable to be rejected or repaired as per the instructions of the Consultants if it is porous or honeycombed, its placing has been interrupted without providing a construction joint or the reinforcement has been displaced proportionately.

The Contractor shall keep a daily record showing the date when each portion of concrete is poured in slab, beam, column, etc., curing period, removal of formwork and test cube results at 7 days and 28 days' period. They shall be sent immediately to the Project Manager/appropriate government authority appointed by GSCDL.

Tests & Standards of Acceptance

Slump Test

The Contractor shall keep at the site of the works for the constant use of the Consultant's representative a standard slump test mold and shall provide facilities throughout the construction for tests to be made as and when the Consultants may require. The slump cannot be definitely stated until tests have been made using the materials adopted for the work, but it is anticipated, that the slump of between 25mm to 50mm will be required.

The Contractor at his own expense shall establish a field laboratory to carry out all preliminary tests, work tests and also to work out grading and proportioning of aggregates in order to obtain and maintain uniform quality of work. A 150 mm cube testing machine shall be installed by the contractor at his own expense to ascertain the strength of concrete from time to time. The contractor shall supply all materials, labor and testing machines for preparing and testing samples as required by the Project Manager/appropriate government authority appointed by GSCDL. The concrete shall also be got tested in an independent laboratory

approved by the Project Manager/appropriate government authority appointed by GSCDL at the discretion of the Project Manager/appropriate government authority appointed by GSCDL representative at no extra cost.

Defective Concrete

Any concrete which gives results below the results specified in relevant paras or becomes severely damaged due to cracking or shows excessive honey-combing and exposure of reinforcement or exhibits any fault which in the opinion of the Project Manager/appropriate government authority appointed by GSCDL, seriously impairs its function, may be declared defective concrete. Such concrete shall be cut out, removed from the site and contractor's own expenses to the satisfaction of the Project Manager/appropriate government authority appointed by GSCDL. Alternatively, the contractor shall carry out at his own expenses whatever other remedy the Project Manager/appropriate government authority appointed by GSCDL may reasonably require having regard to all the circumstances.

Tests

In case of doubt regarding grade of concrete used, either due to poor workmanship or based on results of cube crushing strength, test of concrete on the basis of any or all of the following shall be carried out. The Project Manager/appropriate government authority appointed by GSCDL shall be the final authority for interpreting the results of all these tests and the contractor shall carry out these tests at his own expenses without any additional cost to the Employer.

cxli. Core test

The points from which cores are to be taken and the number and size of cores required shall be the discretion of the Project Manager/appropriate government authority appointed by GSCDL. Cores shall be prepared and tested as described in relevant code.

Concrete in the member represented by a core test shall be considered acceptable if the average Approved Equivalent strength of 85% of the cube strength of the grade of concrete specified for the corresponding age and no individual core has a strength less than 75%.

In case the strength of individual core is found unsatisfactory and below the specified stipulation, approval is to be obtained from the Project Manager/appropriate government authority appointed by GSCDL after submitting necessary proofs in writing on safety and stability of the structure. Decision on acceptance/rejection to this effect given by the Project Manager/appropriate government authority appointed by GSCDL shall be final binding on the contractor.

cxlii. Other non-destructive test e.g. rebound hammer test ultrasonic test- as directed by the Project manager/ appropriate government authority appointed by GSCDL.

Transporting Placing and Compaction of Concrete

The concrete shall be transported maintaining required workability in a manner such as to avoid the segregation of the constituent materials, and loss of any of the ingredients. It shall be deposited as nearly as practicable in its final position to avoid re-handling. It shall be placed and compacted before setting commences and should not be subsequently disturbed. Methods of pouring should be such as to preclude segregation, and to avoid displacement of reinforcement and movement of formwork.

The concrete should be thoroughly compacted and fully worked around the reinforcement, around embedded fixtures

and into the corner of the formwork without formation of honeycombing, pinholes or surface irregularities and any other defects whatsoever. The use of mechanical vibrators having capacity of producing vibrations at a rate not less than 5000 cycles per minute is recommended. Over vibration or vibration of very wet concrete is harmful and should be avoided; under vibration is also harmful. In addition to mechanical vibration, sufficient hand tools must be used to ensure full consolidation around reinforcement and at edges and corners.

The deposition of concrete shall be carried out as continuously as possible to reduce to a minimum joint between new concrete which has set. Where construction joints are necessary they shall be formed at right angles to the axis of the member concerned by the insertion of rigid stopping off form, against which concrete can be properly rammed. Concrete shall not be dropped from a height of more than 1.0M. Non-set concrete shall be brought into contact with unset concrete containing cement of different type. Special permission and instructions shall be obtained when concrete has to be deposited underwater. Underwater concreting shall be done with the help of tremi pipeline only. Concrete shall contain 10% more cement than that required for the specific mix placed in dry condition.

Accumulation of set concrete on the reinforcement shall be avoided. Before fresh concrete is deposited upon or against any concrete which has already hardened, the surface of hardened concrete shall be well roughened if necessary by chipping and all laitance removed. The surface shall then be swept clean with wire brushes, thoroughly wetted and covered with a thin layer of cement mortar.

Care should be taken such that there are no cold joints while laying concrete. Use of Vibrators:

- cxliii. Immersion vibrator shall be inserted vertically at points not more than 450mm apart and withdrawn when air bubble ceases to come to the surface. Immersion vibrator shall be withdrawn slowly.
- cxliv. The immersion vibrator shall penetrate the layer being placed and also penetrate the layer below while the under layer is still plastic to ensure good bond and homogeneity between the two layers and prevent the formation of cold joints.
- cxlv. The use of surface vibrators will not be permitted under normal conditions. However, for thin slabs, such as highways, runways and similar constructions, surface vibration by specially designed vibrators may be permitted upon approval of Project Manager/appropriate government authority appointed by GSCDL.

Protection of Concrete

Newly placed concrete shall be protected by approved means from rain, sun and drying winds. Concrete placed below the ground shall be protected from falling earth during and after placing. Approved means shall be taken to protect immature concrete from damage by debris, excessive loading, vibration, abrasion, deleterious groundwater, mixing with earth or other materials that may impair the strength and durability of concrete.

Working in Extreme Weather

During windy weather efficient protection is to be provided to prevent the cement from being blown away during the process of apportioning and mixing. During wet weather the concrete shall be adequately protected as soon as it is in position. No concreting shall be carried out during period of continuous heavy rain unless it is completely covered during mixing, transporting and

placing. In extreme hot weather, concreting shall be restricted to mornings and evenings. Time between mixing and placing of concrete shall be kept to the minimum and formwork shall be cooled by sprinkling with water before it starts drying out.

Construction Joints

The minimum number of joints should be used, and their construction should be simple. They should be either horizontal or vertical because concreting on sloping surfaces are usually unsatisfactory.

Where concrete is placed in vertical members e.g. walls, columns and the like, the lifts of concrete shall finish on sloping members at right angles to the axis of the members, the joint line matching the features of the finished work. Concreting shall be carried out continuously up to the construction joints.

Laitance, both on the horizontal and vertical surfaces of the concrete, should be removed before fresh concrete is adhesion and sand wet blasted. Various methods for removal can be used. But they should not dislodge the coarse aggregate particles. Concrete may be brushed with a stiff brush soon after casting while the concrete is still fresh, and while it has only slightly stiffened.

If the concrete has partially hardened, it may be treated by wire brushing or with a high pressure water jet, followed by drying with an air jet, immediately before the new concrete is placed.

Fully hardened concrete should be treated with mechanical hand tools or grit blasting, taking care not to split or crack aggregate particles. The best time for treating the joints is a matter of judgement because it depends on the rate of setting and hardening (which is itself dependent on the temperature of the concrete) before further concrete is cast the surfaces should be thoroughly cleaned to remove debris and accumulated rubbish, one effective method being by air jet.

Where there is likely to be a delay before placing the next concrete lift protruding reinforcement should be protected before the next lift is placed, rust, loose mortar, or other contamination should be removed from the bars and where conditions are particularly aggressive and there has been a substantial delay between lifts, the concrete should be cut back to expose the bars for a length of about 50 mm to ensure that contaminated concrete is removed.

In all cases, when construction joints are made, it is essential to ensure that the joint surface is not contaminated with release agents, dust, or curing membrane and that the reinforcement is fixed firmly in position at the correct cover.

Concrete in beams shall be placed throughout without a joint but if the provision of a joint is unavoidable the joint shall be vertical within the middle third of the span unless otherwise shown on drawings. Where a beam intersects a girder, the joints in the girder shall offset a distance equal to twice the width of the beam and additional reinforcement provided for shear the joints shall be vertical throughout the full thickness of the concrete member a joint in a slab shall be vertical and parallel to the principal reinforcement where it is unavoidable at the right angles to the principal reinforcement the joints shall be vertical at the middle third of the span.

Concreting at Construction Joints

When the formwork is fixed for the concreting work it should be inspected to ensure that no leakage is seen from the fresh concrete.

The practice of first placing a layer of mortar or grout when concreting joints is not recommended. The old surfaces should be soaked with water, without leaking puddles immediately before starting concreting then the wet concrete should be thoroughly compacted against it.

When fresh concrete is cast against existing mature concrete or masonry, the older surfaces should be thoroughly cleaned and soaked to prevent the absorption of water from the new concrete. Standing water should be removed shortly before the new concrete is placed and the new concrete should be thoroughly vibrated in the region of the joint. Chemical bonding agents shall be used with the approval of the Project Manager/appropriate government authority appointed by GSCDL at no extra cost.

The use of epoxy for bonding fresh concrete used for repairs will be permitted upon written approval of Project Manager/appropriate government authority appointed by GSCDL. Epoxies shall be applied in strict accordance with the instruction of the manufacturer.

Structural Joints

Expansion joints or other permanent structural joints shall be provided in position and of the form described in the drawings or elsewhere.

In no case shall there be reinforcement, corner protecting angles or other fixed metal items, embedded or bonded into concrete, run continuously through an expansion joint. The placing of concrete on either side of the expansion joint shall be done separately after an interval of at least seven days.

Cutting into Concrete

No concrete shall be cut into, nor shall it be interfered with in any way, without the prior approval in writing of the Project Manager/appropriate government authority appointed by GSCDL. Necessary holes shall be provided as required for plumbing work and for electrical pipes at the time of execution.

Curing of Concrete

Exposed surfaces of concrete shall be kept continuously in a damp or wet condition for at least fourteen days from the date of placing of concrete.

Approved curing compounds may be used in lieu of moist curing with the permission of the Project Manager/appropriate government authority appointed by GSCDL. Such compounds shall be applied to all exposed surfaces of the concrete as soon as possible after the concrete has set and care shall be taken so that the compound shall not affect the concrete. The surfaces shall be cleaned by using wire brushes before plastering without additional cost.

Inserts

The contractor shall fix all necessary steel plates, pipe holes, pockets, dowels etc. in the shuttering of concrete work, to enable subsequent fixing of supports, brackets, ceilings, precast members etc., as indicated in the drawings or as required by the Project Manager/appropriate government authority appointed by GSCDL of Work.

Finishing

Immediately on removal of forms, the RCC work shall be examined by the Project Manager/appropriate government authority appointed by GSCDL before any defects are made good.

- cxlvi. The work that has sagged or contains honey-combing to an extent detrimental to structural safety or architectural concept shall be rejected.
- cxlvii. Surface defect of a minor nature be accepted to acceptance of such work by the Project Manager/appropriate government authority appointed by GSCDL and the same shall be rectified in an approved manner.
- cxlviii. Surface defects which require repair when form is removed usually consist of bulges due to the movement of forms, ridges at form joints, honey combed areas, damage resulting from the stripping of forms and bolt holes. Bulges and ridges are to be removed by careful chipping or tooling and the surface is then rubbed with a grinding stone, honey combed, and other defective areas must be chipped out, the edges being cut as straight as possible and perpendicular to the surface or preferably slightly undercut to provide a key at the edge of the patch. Bolt holes shall be closed by cement mortar to ensure through filling.
- cxlix. Shallow patches are first treated with a coat of thin grout composed of one part of cement and one part of sand and then filled with mortar similar to that used in the concrete. The mortar is placed in layers is given a scratch finish to secure bond with the succeeding layer. The last layer is finished to match the surrounding concrete by floating, rubbing or trowelling on formed surfaces by pressing the form material against the patch while the mortar is still plastic. Bonding compound shall be used without any extra cost.
 - cl. Large and deep patches require filling up with concrete held in place by forms. Such patches are to be reinforced and carefully doweled to the hardened concrete
 - cli. The same amount of care to cure the material in the patches should be taken as with the whole structure. Curing must be started as soon as possible, after the patch is finished to prevent early drying. Damp hessian may be used but, in some location, it may be difficult to hold it in place. A membrane curing in these cases will be most convenient.
 - clii. On receiving approval of the Project Manager/appropriate government authority appointed by GSCDL the exposed concrete surfaces of substructure and superstructure above well cap shall be finished with two coats of cement based paint of approved shade and quality.

Pre-Cast Concrete

All aforesaid specifications for concrete shall apply to precast concrete in addition to the following variations. The concrete in one precast piece shall be placed in one operation. No piece shall be removed from the moulds or erected until sufficiently matured to ensure that no damage shall be done to the piece.

All details of jointing, inserts, anchors and bearing widths shall be as shown on the drawings.

All precast concrete members shall be clearly marked to indicate the top of the member and its location.

Units shall be stored, transported and placed with due care so that they will not be overstressed or damaged.

Precast units shall be adequately braced and supported during erection to ensure proper alignment and safety, and such bracings and supports shall be maintained until there are adequate permanent connections.

Plum Concrete Course

The unevenness in the founding strata shall be leveled using plum concrete. The pockets in the founding strata shall be filled with plain cement concrete of lean mix. Plums above 160mm and up to any reasonable sizes shall be embedded in the plain cement concrete layer up to a maximum limit of 20 percent by volume of plain concrete when specifically permitted by the Project Manager/appropriate government authority appointed by GSCDL. The plums shall be distributed evenly and shall be no closer than 150mm from the surface.

Levelling Course

It shall be plain cement concrete of leaner mix which shall be proportional as stipulated and placed in position conforming to line and level shown on the drawing and compacted by approved means and cured.

Supervision

Constant and strict supervision at all items of the construction is necessary during the progress of the work, including the proportioning and mixing of the concrete. Supervision is also of extreme importance to check the reinforcement and its placing before being covered. Before any important operations, such as concreting or striking off the formwork is started, notice shall be given to the Project manager/ appropriate government authority appointed by GSCDL.

Formwork

The Form work shall be designed for rigidity and durability, strength, watertightness, easy removal, surface finish required for concrete in contract with shuttering and economy.

Material used in formwork shall be 12mm thick film faced shuttering plywood's, steel props, steel plates, or specially designed and manufactured molds out of plastic or reinforced fiber glass or steel.

Use shall depend upon its location, type of finish specified subject to acceptability by Project Manager/appropriate government authority appointed by GSCDL. Form work designed with proposed material in use should be able to retain its shape, lines, and dimensions, shown in the drawings. It should safely carry the full load of concrete self-weight, reinforcement weight together with any live and impact load likely to occur during concreting.

Material used shall conform to relevant IS codes. It is the contractor's responsibility to entirely achieve the standard expected to the satisfaction of the Project Manager/appropriate government authority appointed by GSCDL.

Workmanship

Erection of formwork may be from pre-molded, pre-fabricated, pre-assembled plates or forms reasonable enough to transport and erect at site to correct line and level as set out at site. Supports shall be firm and maintained in position by nails, cross bracings, tie rods, locking bolts and nuts. It shall be rigid and stiff so as to retain its shape during and after concreting.

Joints shall be water tight and no cement slurry shall be allowed to slip through.

Pre-fabricated or site fabricated forms shall be assembled, so as to de-shutter without any jerk to the green concrete. For this, double wedges shall be used. Wedges shall be nailed, the heads reasonably left out, allowing easy removal while de-shuttering.

Pre-fabricated or site fabricated forms shall be of sufficient thickness and with the required supporting runners in either direction. Supporting runners shall be standardized in size for easy replacement and universal use at site.

Props shall be of steel only. Size and vertically shall be approved by the Project Manager/appropriate government authority appointed by GSCDL. Its spacings shall be as per design. It shall be vertical and plumb. Base shall be proper steel plate or timber plank, for equal distribution of load. The concreting of the upper floor shall be done only after 14 days of concreting of lower floor.

Beams and slabs shall have camber of 4mm per meter or as directed by the Project Manager/appropriate government authority appointed by GSCDL.

All angles and corners shall be sharp and well defined in places where concrete edges are permanently exposed and require no further treatment, they shall be chamfered in a triangle of 25x 25mm. Props of steel or timber shall be provided with adequate horizontal and cross-bracing. Steel props shall use steel pipes and steel couplers. If use of timber is permitted, planks of 100x 25mm shall be used and shall be secured by nailing them to timber props. No other material shall be permitted.

At the design and erection stage, the following additional points shall be considered and incorporated into the shutters.

- cliii. Openings for cleaning prior to start of concreting.
- cliv. Pouring points shall avoid high drops and provide easy access to vibrator needles.

Surfaces shall be treated with mold releasing oil emulsion as approved by the Project Manager/appropriate government authority appointed by GSCDL prior to reinforcement laying. The following points shall be observed very carefully:

- clv. Joints of molds shall be water-tight. It is easy to check from the bottom and make sure that no light is visible.
- clvi. Props shall be on solid base, plumb, in one straight line and braced horizontally and cross. c. Tie bars in beams, walls and columns shall be at the correct place and fully tight.
- clvii. Wedges shall be fully secured and nailed with heads left out for easy removal.
- clviii. All sawdust, dirt, shavings and any other unwanted materials shall be cleaned and hosed out.
- clix. Provisions shall be made for watching form work while concreting and any other platform needed for movement of workers without any disturbance of reinforcement.

Form work shall be erected in accordance with:

- clx. IS 3696 safety code of scaffolds and ladders.
- clxi. IS 4014 code of practice for steel tubular scaffolding I and II. Part- 2
- clxii. Safety regulation for scaffolding.
IS 8989 safety code for erection of concrete framed structures

Special Fair Faced Finish

Where special fair faced finish is specified, the contractor shall be responsible for producing a perfectly smooth surface to the concrete, free from projections or imperfections of any description. Surfaces must be clean, sharp and perfectly sound. The formwork must be designed so that it can be erected and maintained perfectly plumb and all surfaces must be true planes free from winding or other deformities throughout. Tying wires through the concrete to hold the formwork together will not be permitted and either exterior bracing or through bolts are to be employed. If the latter are used the bolts shall subsequently be removed and the holes plugged with cement mortar. The pattern of holes shall be to the approval of the Consultants. No part of any metal tie or spacer remaining permanently embedded in the concrete shall be nearer than 50 mm to the finished surface of the concrete. Concrete faces must be protected at all times during and after construction against accidental damage or disfiguration and the contractor will be responsible for taking all necessary measures to ensure that the work is perfectly sound and free from blemishes, stains, etc., when finally handed over.

Removal of Formwork

Under normal circumstances and where O.P. Cement is used, forms shall be removed after expiry of the following periods. As per IS 456-2000

clxiii.	Walls, columns and vertical faces	24 to 48 hours
clxiv.	Slabs (props left under)	7 days
clxv.	Beams-soffits (props left under)	7 days
clxvi.	Removal of props under slabs	
	x) Spanning up to 4.5M	7 days
	y) Spanning over 4.5M	14 days
clxvii.	Removal of props under beams and arches	
	z) Spanning up to 6M	14 days
	aa) Spanning over 6M	21 days

For other cements, the stripping time shall be suitably modified in consultation with the Project Manager/appropriate government authority appointed by GSCDL.

Where the shape of elements is such that the formwork has re-entrant angles, the formwork shall be removed as soon as possible after the concrete has set, to avoid shrinkage or cracking that might occur due to the restraint imposed.

For precast molds, the stripping time shall be 24 hours. The mold may be lifted and stored in the yard within 24 hours to 48 hours as approved by the Project Manager/appropriate government authority appointed by GSCDL.

Openings/ Inserts

All required openings and pockets shall be provided as detailed in the drawing. They may be enumerated or paid on area basis as detailed in the BOQ. The contractor shall provide for the required material, labour, for fixing and supporting during concreting, in his quoted price. It is imperative that all openings and pockets shall be de-shuttered with care and all corners of openings shall be preserved. All openings/pockets shall be in a correct line and level.

After concreting, the openings shall be secured against any accident by proper covering and guard-rail and warning notice, if any.

The contractor shall clean and grout the pocket at a later date with a non-shrinking compound added to the grout mix or non-shrinking cement shall be used. It shall be well-cured and protected to correct line and level till handing over.

Inserts are material such as timber, steel, plastic, dowels, bolts, locks, brackets, pipes etc. left in concrete partly or fully embedded to receive connection with foreign member at a later date. These may be fabricated by the contractor or provided by the owner as received from specialist, manufacturer, etc. These shall be protected from weathering and damage in course of the construction. The cleaning required after concreting and any treatments such as oiling, greasing or covering with paint etc., shall be carried out by the contractor at his cost.

It is very important that the providing and fixing as contemplated in the BOQ shall be carried out with the "utmost precision" and to the entire satisfaction of the Project Manager/appropriate government authority appointed by GSCDL. Any deviation from that as shown in the drawings or instructions shall be rectified by the contractor at his own cost and responsibility.

Preparation of Formwork before Concreting

Special Provision

Wherever the concreting in narrow members is required to be carried out within shutters of considerable depth, temporary openings in the sides of the shutters shall, if so directed by the Project Manager/appropriate government authority appointed by GSCDL, be provided to facilitate the pouring and consolidation of the concrete. Small temporary openings shall be provided as necessary at the bottom of shutters of walls and deep beams to permit the expulsion of rubbish, etc.

Discoloration

Formation of blotches and stains due to detachment of formwork panel from the concrete when adjacent portion to the same lifts is still adhering, shall not be allowed to occur, and for this purpose, all shutters shall be struck off at the same time.

STONE MASONRY

4.1. Indian Standards

The following Indian Standards apply to this section.

I.S No.	Subject
1121 (Part-I) - 1974	Method of test for determination of strength properties of natural building stone Part- I - Compressive strength (first revision).
1124 -1974	Method of test for determination of water absorption, apparent specific gravity and porosity of natural building stones (first revision).
1597 -1967	Code of practice for construction of stone masonry.
1706 -1972	Method for determination of resistance to wear by abrasion of natural building stones (first revision)

4.2. Stone

The stone shall be of the type specified such as granite, trap, other igneous rock, sand stone, etc., and shall be obtained from the approved quarries as indicated.

Stones shall be hard, sound, durable and free from weathering, decay and defects like cavities, crack, flaw, sand holes, injurious veins, patches of loose or soft materials and other similar defects that may adversely affect its strength and appearance. As far as possible, stones shall be of uniform colour and texture. Generally, stones shall not contain Crypto Crystalline silica or chert, mica and other deleterious materials like iron oxide, organic impurities etc.

4.2.1. The compressive strength and water absorption of common type of stones are given in the table below

Type of stones	Water absorption, percentage by weight max.	Compressive strength Kg/Sq. cm. Min.
Granite	0.50	1000
Basalt	0.50	400
Sand stone	2.50	300
Marble	0.40	500
Laterite stone	Not more than 12% by mass	35

4.2.2. Laterite Stone

The laterite stone shall be compact in texture and mottled and streaked with various colours like brown, red & yellow. It shall not contain white clay lithomarge or appreciable number of sinuous sites, which are deep. The blocks should be obtained as far as possible from a good ferruginous laterite which hardens on exposure after it is quarried. The Laterite stone shall be machine cut and obtained from an approved quarry.

The specific gravity of laterite stones shall not be less than 2.5. The compressive strength of the blocks to be used in masonry work shall not be less than 35 kg/cm² in its dry condition. The water absorption after 24 hours of immersion in water shall not be more than 10%. Laterite stone shall be dressed soon after quarrying when it is soft enough to be cut with a pick and easy to make into rectangular blocks. After quarrying, the stones shall be allowed to season for some time before using in work.

4.3. Dimensions of Stones

Unless otherwise indicated, the length of stone for stone masonry shall not exceed three times the height and the breadth on bases shall not be greater than three-fourth the thickness of wall. Height of stone may be upto 30 cms. Minimum dimensions of stones for various types of masonry shall be as given below.

- clxviii. Stone for random rubble masonry may be of any size and shape but shall be not less than 15 cms in any direction.
- clxix. Stones for squared rubble masonry shall be not less than 15 cms in length and width.
- clxx. Stones for block-in-course masonry shall be not less than 20 cms in breadth or height and length not less than twice the height.
- clxxi. Stones for ashlar masonry shall be not less than 30 cms in breadth and height and length not less than twice the height.

4.4. Masonry Mortars

4.4.1. Cement

Cement shall be of ordinary Portland cement, Portland blast furnace slag cement or pozzolana cement as specified.

4.4.2. Sand for masonry mortar

Unless otherwise indicated sand for masonry mortar shall consist of natural sand, crushed stone sand or crushed gravel sand or the combination of any of these conforming to I.S. 2160 – 1980 specification for sand for masonry mortar. Sand shall be hard, durable, clean and free from adherent coating and shall not contain clay and impurities such as iron, pyrites, salt, coal, mica, Shale or similar laminated or other materials.

The maximum quantity of clay, fine silt and fine dust in sand shall not be more than 5% by mass. Organic impurities shall be below that obtained by comparison with a standard solution.

4.4.3. Proportioning

Mortar should be of the mix as indicated. The mix specified shall be proportioned by volume of cement to dry sand.

4.4.4. Preparation of cement mortar

Mixing should be done preferably in mechanical mixer. If hand mixing operation shall be carried on a clean water tight platform. Cement and sand shall be mixed dry in the required proportion to obtain a uniform colour. The required quantity of water shall then be added, and the mortar hoed back and forth for 5 to 10 minutes with addition of water to a workable consistency. In the case of mechanical mixing the mortar shall be mixed for at least three minutes after addition of water. Cement mortar should be freshly mixed for immediate use. Any mortar which has commenced to set shall be discarded and removed from the site.

4.5. Dress Stone Work

The various dressing specified shall have the following meanings

- clxxii. Rubble: Stones of irregular shapes and sizes as quarried, with irregular angles taken off.

- clxxiii. Self-faced surfaces: Surface of stone slabs used for roofing, flooring, lintel etc., as obtained from quarry.
- clxxiv. Squared Back Surface: Mean the
surfaces shall be dressed back at right angle to the face of stone.
- clxxv. Chisel Drafted Margin: The dressing done with a drafting chisel in narrow strips of width generally 2 to 5 cms chisel drafted margin shall be punched dressed.
- clxxvi. Hammer Dressed Surfaces: A hammer dressed stone shall have no sharp and irregular corners and shall have a comparatively even surface so as to fit well in masonry. Hammer dressed stone is also known as hammer faced, quarry faced and rustic face. The bushing from the general wall face shall not be more than 40 mm on an exposed face and 20 mm on surfaces to be rendered.
- clxxvii. Punched Dressed Surfaces:
A rough tooled surface is further dressed by means of a punch chisel to show series of parallel ridges. The depth of gap between the surface and a straight edge held against the surface shall not exceed 3 mm.
- clxxviii. Close Picked Surfaces: A punched stone is further dressed by means of a point chisel, so as to obtain a finer surface, ridges or chisel marks left over being very tiny. The depth of gap between the surface and a straight edge kept over the surface shall not exceed 1.5 mm.
- clxxix. Polished Surfaces: Surfaces having a high gloss finish.

4.6. Types of Stone Masonry

4.6.1. Random Rubble Masonry

- clxxx. **Uncoursed:** This type of masonry is constructed of stones as they come from the quarry. The mason selects stones of all shapes and sizes, more or less at random and places them in position to obtain a good bond, while restricting cutting of the stones to the removal of inconvenient corners with scabbling or spalling hammer.
- clxxxi. **Brought to Courses:** This walling is similar to uncoursed random rubble except that the work is roughly levelled up to courses at intervals varying from 30 cm to 60 cm in height according to the locality and the type of stone used.

4.6.2. Polygonal Rubble Masonry

Stone with no pronounced stratification is roughly hammer dressed or pitched into irregular polygonal shapes and bedded to show the face joints running irregularly in all directions.

4.6.3. Squared Rubble Masonry

- clxxxii. **Uncoursed:** In this type, the stones are roughly squared as risers or jumpers and stretchers with varying heights and laid uncoursed.
- clxxxiii. **Brought to Courses:** The stones are similar to those used for uncoursed rubble, but the work is levelled to courses of varying depth from 30 cm to 60 cm according to the locality and the type of stone used.
- clxxxiv. **Coursed:** Coursed walling is built in courses which may vary in height from 15 to 30 cms but the stones in any one course are roughly squared to the same height.

4.6.4. Block in course Masonry

This is hammer faced, regular coursed masonry in large blocks.

4.6.5. Ashlar/Plain Ashlar Masonry

Stone blocks of the same height in each course are used and every stone is roughtoed on all beds and joints, full and true and faces dressed as indicated.

4.7. General Requirements for Stone Masonry Construction

- clxxxv. All stone masonry shall be set out and built to the respective type dimensions, thickness and heights as indicated.
- clxxxvi. All labours on stone shall normally be executed when it is freshly quarried.
- clxxxvii. Stone shall be sufficiently wetted before laying to prevent absorption of water from mortar.
- clxxxviii. The natural bed of the stratified stone shall be so laid that the pressure is always perpendicular to the strata. Stones in walling, steps, copings, sills etc., shall be placed with the grain or natural bed, horizontal.
- clxxxix. The courses shall be built perpendicular to the pressure which the masonry will bear. In case of battered walls, the beds of stones and the plane of course shall be at right angle to the batter.
- cxc. Vertical joints shall be staggered as far as possible. In the case of squared rubble coursed masonry block in course masonry and ashlar masonry, stones shall break joints, on the face for at least half the height of the course and the bond shall be carefully maintained throughout.
- cxci. Stone shall be laid on a full bed of mortar. All joints shall be properly flushed and packed.
- cxcii. The walls and pillars shall be carried up truly plumb or to the specified batter.
- cxciii. No part of the wall during its construction shall rise more than 1 meter above the general construction level to avoid unequal settlement. Where there is a break in masonry work, the masonry shall be raked back in sufficiently long steps for facilitating joining of old and new work. The stepping of the raking shall not be more than 30 degrees with the horizontal.
- cxcv. At all angular junctions, the stones in each alternative courses shall be well bonded into the respective course of the adjacent wall.

4.8. Protection

Care shall be taken during construction that the edges of jambs, sills, heads etc., or not damaged. In inclement weather new built work shall be suitably protected by covering with gunny bags or tarpaulin.

4.9. Curing

Masonry work shall be kept constantly moist on all the faces for a minimum period of seven days. Watering shall be done carefully so as not to disturb or wash out green mortar.

4.10. Bond Stones

Dressing of bondstones shall be done as for other stones. In coursed masonry full surface of the bed shall be dressed. In random rubble masonry, bond stones shall be hammer dressed on the face, beds and joints and made into a squared block.

4.11. Plain Cement Concrete Bond Stones

Plain Cement Concrete Bond Stones of mix 1:3:6 may be provided in lieu of stone bondstones, where indicated. The size and spacing of PCC bondstones shall be as specified for stone bondstones and shall be laid on the full section of the walling in one piece.

4.12. Mode of Measurement

Stone masonry shall be measured in cubic meters. The work of pointing shall be measured in square meters of the surface treated.

BRICK WORK

5.1. I.S. Codes

The following I.S. apply to this section:

I.S. NO.	SUBJECT
1077-1986	Specification for common burnt clay building Bricks.
1905-1980	Code of practice for structural safety of building masonry wall (Second Revision)
2116-1980	Specification of sand for masonry mortar (First Revision)
5454 -1978	Method of sampling of clay building Bricks (First Revision)
2250	Code of practice for preparation and use of masonry cement.

5.2. Materials

5.2.1. Bricks

Bricks shall be sound, hard, well-burnt, uniform in size, shape and colour, homogeneous in texture, giving a metallic ringing sound, free from flaws, cracks, holes, lumps or grit and bricks should be square, straight and sharply defined. They shall not break when struck against each other and dropped flat from a height of 1 m to the ground. They shall conform to IS 1077 giving classes of common burnt clay bricks. Maximum absorption shall not be more than 20% of its dry weight on immersion in water for 24 hours. Minimum crushing strength shall be 75 kg/sq cm. Bricks for masonry work in foundations as well as in superstructure shall be first class burnt clay bricks conforming to Sikkim PWD Specifications. C.R. Masonry shall be with conformity to I.S.1597. Brick masonry shall be with conformity to I.S.2212. Cement plastering shall be with conformity to I.S.9103 & 6925. Mortar shall be with conformity to I.S.2250.

5.2.2. Cement

Cement shall be of ordinary Portland cement, Portland blast furnace slag cement or pozzolana cement as specified.

5.2.3. Sand for Masonry Mortar

Unless otherwise indicated sand for masonry mortar shall consist of natural sand, crushed stone sand or crushed gravel sand or the combination of any of these conforming to I.S. 2160-1980 specification for sand for masonry mortar. Sand shall be hard, durable, clean and free from adherent coating and shall not contain clay and impurities such as iron, pyrites, salt, coal, mica, Shale or similar laminated or other materials.

The maximum quantity of clay, fine silt and fine dust in sand shall not be more than 5% by mass. Organic impurities shall be below that obtained by comparison with a standard solution.

5.2.4. Common Burnt Clay Building Bricks

Common burnt clay building bricks (hereinafter termed as "Bricks") shall conform to the requirement laid down in I.S. 1077 – 1986, specification for common burnt clay building Bricks. The class of Bricks, based on minimum compressive strength, 35, 50, 75, 100 or 125 and their sub

class A or B shall be indicated. Sub class A bricks shall have smooth rectangle faces with sharp corners and shall be uniform in colour.

5.2.5. Dimensions: Size of Standard Bricks shall be as under

TYPE OF BRICKS	NOMINAL SIZE	ACTUAL SIZE
Modular Bricks	20x10x10 cms	19x9x9 cms
Old size Bricks (FPS)	9x4.5x3 inches OR 23 x 11.3 x 7.5 cms	9x 4 3/8 x 2 3/4 inch

5.2.6. Tolerance:

The permissible tolerance on the dimensions of the Bricks unless otherwise indicated, shall be + or - 3% for class A Bricks and + or - 8% sub class B Bricks.

5.2.7. General quality:

Bricks may be hand or machine molded and shall be made from suitable soils. They shall be free from cracks, flaws and nodules of free lime. Bricks of 7.5 cms, 10 cms thickness (height) shall be molded with frog 1 to 2 cms deep on one of its flat surfaces.

5.2.8. Compressive Strength:

The compressive strength of individual Bricks shall not fall below the minimum average compressive strength specified for class of Bricks by more than Twenty percent

5.2.9. Water Absorption:

The average water absorption of Bricks, after immersion in cold water for 24 hours shall not be more than Twenty percent (for Bricks up to Class 125).

5.2.10. Efflorescence:

The rating of Efflorescence of the Bricks shall not be more than moderate (for Bricks Class 125).

5.2.11. Handling and Storage:

Bricks shall not be dumped at site, they shall be stacked in regular tiers on even ground as they are unloaded to minimize breakage and defacement of Bricks, Bricks stacked for facing and any particular purpose/situation of use shall be stacked separately.

5.2.12. Masonry Mortars

- cxcvi. Proportioning: Mortar should be of the mix as indicated, the mix specified by volume in proportion of cement to dry sand.
- cxcvii. Preparation of Cement Mortar: Mixing should be done preferably in mechanical mixer. If hand mixing operations shall be carried on a clean water tight platform. Cement and sand shall be mixed dry in the required proportion to be obtained a uniform colour. The required quantity of water shall then be added, and the mortar hoed back and forth for 5 to 10 minutes with addition of water to a workable consistency. In the case of mechanical mixing the mortar shall be mixed for at

least three minutes after addition of water. Cement mortar should be freshly mixed for immediate use. Any mortar which has commenced to set shall be discarded and removed from the site.

5.3. Setting Out

All Brick work shall be set out and built to the respective dimensions, thickness and height as indicated.

5.4. Scaffolding

Scaffolding shall be strong to withstand all dead, live and impact loads which are likely to come on that. Scaffolding shall provide to allow easy approach to every part of work, overhead work shall not be allowed. For exposed brick facing double scaffolding having two sets of vertical supports shall be provided. For brickwork which is to be plastered over, single scaffolding may be provided. In single scaffolding one end of putlog shall rest in the hole provided in the header course of brick masonry. Not more than one header for each putlog shall be left out. Such holes shall not be allowed in the case of pillar or narrow masonry portions, between the openings, which are less than 1 m width or are immediately under or near the structural member supported by the walls. The holes left shall be made good on removal of scaffolding to match with the face work/surrounding area.

5.5. Soaking of Bricks

Bricks shall be soaked in water before use for a period for the water to just penetrate the whole depth of bricks. Alternatively bricks can be soaked in stacks by profusely spraying with clean water on regular intervals for a period not less than six hours.

5.6. Laying

All loose materials, dirt and set lumps of materials which may be laying over the surface on which brick work is to be freshly started shall be removed with wire brush and surface wetted slightly. Bricks shall be laid on a fully bed of mortar. When laying, the bricks shall be properly bedded and slightly pressed with handle of trowel, so that the mortar can get into all pores of the brick surface to ensure proper adhesion. All the joints should be properly flushed and packed with mortar, so that no hollow space are left. Care shall be taken to see that the required quantity of water is added to the mortar at the mixing platform to obtain required consistency. Addition of water during laying of courses shall not be permitted. In the case of wall two brick thick and over, the joints shall be grouted to every course in addition to bedding and flushing with mortar.

While using old size bricks, (FPS conventional bricks) top courses of plinth, parapet, steps and top of walls below roof slab or floor slab shall be laid on brick edge, applicable in case of additional bricks unless directed otherwise. Care shall be taken that brick forming top courses and ends of wall are properly keyed into position.

Brick shall be laid frog up however, when the top course is exposed, brick shall be laid with frog down, care shall be taken to fill the frogs with before embedding the bricks in position.

All quoins shall accurately construct, and the height of course checked with storey rods as the work proceeds. Acute and abut quoins shall be bonded. Where practicable, in the same way as square quoins, abut quoins shall be formed with squint showing a three quarter brick on one face and quarter brick on the other.

5.7. Bond

All brick work shall be built in English bond, unless otherwise indicated, half brick wall shall be built in stretcher bond. Header bond shall be used for walls curved on plan for better alignment. Header bond shall also be used in foundation footings; stretcher may be used when the thickness of wall renders use of header impracticable. When the thickness of footings is uniform for the number of courses, the top course of the footing shall be header. Half or cut bricks shall not be used except where necessary to complete the bond.

Overlap in stretcher bond is usually half brick and is obtained by commencing each alternate course with the half brick. The overlap of the header bond which is usually half the width of the brick is obtained by introducing three quarter brick, in each alternate course at quoins, in general, the cross joints in any course of brick work shall not be nearer than quarter of the brick length, from these in the course below or above it.

5.8. Uniformity

The brick work shall be built, in uniform layers, corners and other advance work shall be raked back. No part of the wall during its construction shall rise more than one meter above the general construction level, to avoid unequal settlement. Part of wall left at different levels shall be properly raked back. Nothing may be done where future construction is contemplated but shall not be used as an alternative to raking back. For half brick partition to be keyed into main walls, indents shall be left in the main walls.

5.9. Alignments and Perpend

The wall shall be taken truly plumb, or true to required batter, where specified. All courses shall be laid truly horizontal and all vertical joints shall be truly vertical. Vertical joints in alternate courses directly one over the other. (Quoins, jambs) and other angles shall be properly plumbed as the work proceeds. The maximum permissible tolerance in masonry shall be as under.

- cxcviii. Deviation from vertical within a storey per 3M height-6mm
- cxcix. Deviation from vertical in total height of building-12.5mm
- cc. Deviation of bed joints from horizontal.
 - bb) In any length upto 12M - 6 mm
 - cc) In any length over 12M - 12.5mm total

5.10. Thickness of Joints

Thickness of joints such that four courses and three joints shall be taken consecutively shall measure as follows unless and otherwise specified.

- cci. Old size brick—equal to four lines the actual thickness plus 4cms.
- ccii. Modular brick—equal to 39 cms

5.11. Striking Joints

When no pointing, plastering or other finish is indicated, the green mortar shall be neatly struck flush, where pointing, plastering or other finishes are indicated, the joints shall be raked out to a depth of not less than 10mm for plastering and 15mm for pointing.

5.12. Protection against Damage

Care shall be taken during the construction the edges of jambs, sills, heads etc., are not damaged. In inclement weather, newly built work shall be covered with gunny bags or tarpaulins, so as to prevent the mortar from being washed away.

5.13. Curing

The Brick work shall be constantly kept wet for at least seven days.

5.14. Facing

In the case of walls of one brick thick and under at least one face shall be kept even and in proper plane, while the other face may be slightly rough. In the case of walls more than one brick thick, both the faces shall be kept even and in proper plane.

5.15. Cleaning

Face of the brick work shall be cleaned on the same day it is laid and all mortar droppings removed.

5.16. Half Brick Masonry

Half brick masonry walls shall be provided with PCC 1:3:6, 75 mm thick band reinforced with 2 Nos, 8 mm tor steel rods at every 5th course for the full length of wall.

5.17. Mode Of Measurement

All brick work shall be measured in cubic meters. Architectural coping shall be measured in linear meters. The rates shall include cost of all labour, T&P, scaffolding etc. The rates shall also include full compensation for using specially molded bricks on the face of walls and provision of weep holes where necessary

CONCRETE WORKS - CONCRETE MASONRY UNITS SOLID LIGHT WEIGHT CONCRETE BLOCKS

6.1. Indian Standards

The following Indian standards applied to solid block masonry:

I.S. Code	SUBJECT
2185 (Part II)-1983	Specification for concrete masonry units (Part II) hollow and solid light weight concrete blocks

6.2. Materials

6.2.1. Concrete Block

- cciii. Concrete block, hollow or solid shall be referred to by its nominal dimensions. The term "Nominal" means that the dimension includes the thickness of the mortar joint. Actual dimensions shall be 10 mm short of the nominal dimension.
- cciv. The nominal dimensions of the concrete block shall be as follows:
 - dd) Length 400, 500 or 600 mm
 - ee) Height 100 or 200 mm
 - ff) Width 75, 100, 150, 200, 250 or 300
- ccv. In addition, blocks shall be manufactured in half length of 200, 250 or 300 mm that correspond to the full lengths. The nominal dimensions of the units are so designed that taking account of thickness of mortar joints, they will produce wall lengths and heights which will conform to the principal modular co-ordinations.
- ccvi. The maximum variations in the length of units shall not be more than + or - 5 mm and maximum variation in height and width of unit, not more than + or - 3 mm.
- ccvii. The surface characteristics of the blocks intended to be plastered or rendered, shall be such as to provide satisfactory bond with the plaster.
- ccviii. Faces of blocks shall be flat and rectangular, opposite faces shall be parallel and all rises shall be squared. The ends of blocks which form the vertical joints may be plain but unless tongue and grooved or double ends are indicated.
- ccix. The blocks shall be cured in an immersion tank or in the curing yard and shall be kept continuously moist for at least 21 days. When blocks are cured in immersion tank, the water in the tank shall be changed at least every four days.
- ccx. Steam curing of blocks may be adopted provided the requirements of pressure or non-pressure steam curing is fulfilled. After curing the block shall be dried in shade before being on the work. They shall be stacked with voids horizontal (for hollow blocks) to facilitate the through passing of air, the blocks shall be allowed to complete their initial shrinkage before they are laid in a wall.

6.2.2. Wetting Of Blocks

Blocks will be wetted before or during laying in the walls, in case the climatic condition so require the top and the sides of the blocks, may only be slightly moistened so as to prevent absorption of water from the mortar and ensure development of required bond with the mortar.

6.2.3. Laying

Blocks shall be laid in mortar, as indicated and thoroughly bedded in mortar spread over the entire top surface of the previous course of the blocks in a uniform layer of not less than 10 mm in thickness and not more than 12 mm.

All courses shall be laid truly horizontal and all vertical joints made truly vertical. Blocks shall break joints with those above and below or not less than quarter of their length. Precast half-length closers (and not cut from a full size block) shall be used. Care shall be taken during construction to see the edges of the blocks are not damaged.

6.2.4. Intersecting Walls

When two walls meet or intersect and a course is to be laid up at the same time, a true bond between at least 50% of the units at the intersection is necessary.

When such intersecting walls are laid up separately, pockets with 20 mm maximum vertical spacing shall be left in the first wall laid. The corresponding course of the second wall shall be built into these pockets.

6.2.5. Finishes

Rendering shall not be applied to the walls when these are wet, joints for plastering as specified shall be raked to a depth of 10 mm. Joints on internal faces, unless otherwise indicated, shall be raked for plastering. If the internal faces of masonry are not to be plastered, the joints shall be finished flush as the work proceeds or pointed flush where indicated.

6.2.6. 100mm Block Work

100 mm solid block wall will be provided with PCC 1:3:6, 75 mm thick band reinforced with two Nos. 8 mm dia tor steel rods at every 5th course for the full length of wall.

6.2.7. Mode of Measurement

Block masonry shall be measured in cubic meters. The work of pointing shall be measured in square meters of the surface treated.

PLASTERING

Indian Standards

The following I.S. apply to this section:

I.S. NO.	SUBJECT
1542 –1977	Specification for sand for plaster (First Revision)

Cement plaster will be executed in the specified mortars as per Sikkim PWD building Specifications. For cement rendering and for cement pointing Sikkim PWD building Specifications shall be followed. Cement plastering shall be with conformity to I.S.9103 & 6925. Mortar shall be with conformity to I.S.2250

Materials

Cement

Cement shall be ordinary port land cement or port land blast furnace cement or port land pozzolana cement as specified.

Sand

Sand for plastering shall conform to I.S. 1542– 1977: Specification for sand for plaster. Sand shall consist of natural sand, except where crushed stone sand or crushed gravel sand or combination of any of these indicated. The sand shall be hard, durable, clean and free from adherent coating and organic matter and shall not contain appreciable amount of clay balls, sand shall be obtained from approved sources.

Sand shall not contain any harmful impurities, such as iron pyrites, alkalis, salts, coal, mica shale or similar laminated materials, soft fragments, sea shells and organic impurities in such quantities as to affect adversely the hardening, the strength and durability or the appearance of plaster or applied decoration or to cause corrosion of metal lathing, or other metal in contact with plaster. The maximum quantity of clay, fine silt, stone dust shall not be more than 5 percent by weight.

The particle size, grading of sand for plaster work shall be as under, unless otherwise specified to conform to the sample maintained by the Project Manager/appropriate government authority appointed by GSCDL..

IS SIEVE DESIGNATION	PERCENTAGE PASSING BY WEIGHT
10 mm	100
4.75 mm	95 – 100
2.36 mm	95 – 100
1.18 mm	90 – 100
600 Microns	80 – 100

300 Microns	20 – 65
150 Microns	0–5

Water

Water is used for mixing and curing shall be clean, free from deleterious matter and also from unusual proportion of dissolved salts. Sea water or tidal estuary or brackish water shall not be used. Water fit for drinking is normally suitable.

Scaffolding

Where possible independent scaffoldings shall be used to obviate the subsequent restoration of masonry in put log and other breaks in the work. Stage scaffoldings shall be provided for ceiling plastering.

Cement Mortar

Mortar should be of the mix as indicated, the mix specified by volume in proportion of dry cement and dry sand.

Preparation of Cement Mortar

Mixing should be done preferably mechanical mixer. If hand mixing operations shall be carried on a clean water tight platform. Cement and Sand shall be mixed dry in the required proportion to obtain uniform colour. The required quantity of colour shall then be added and the mortar hoed back and forth five to ten minutes with addition of water to a workable consistency. In the case of mechanical mixing the mortar shall be mixed for at least three minutes after addition of water. The cement mortar freshly mixed for immediate use. Any mortar which has commenced to set shall be discarded and removed from the site.

Preparation of Back Ground for Application of Mortar

All dirt, dust and other foreign matter all masonry and laitance on the concrete surface shall be removed by watering and brushing as required. If the back ground contains soluble salts, particularly sulphates, the application of plasters shall be done one after the efflorescence of the salts is complete and efflorescence is completely removed from the surface. Any trace of Algae or Moss formations shall be removed. Joints in brick work shall be raked out to a depth not less than 10 mm as you proceed, local projections in brickwork beyond the general wall face shall be trimmed off where necessary.

Roughness

Smooth surface of in situ concrete walls and ceiling etc., shall be roughened by wire brushing, if it is not hard, and by hacking or bush hammering if it is hard, to provide for proper adhesion. Projecting burrs of mortar because of gaps at joints in shuttering shall be removed. Surface shall be kept clean with wire brushes, in addition concrete surfaces shall be pock marked with a pointed tool at facing of about 50 mm the pocks made to be not less than 3 mm deep.

Suction Adjustments

Adequate drying intervals shall be allowed between the erection and plastering to bring the surface suitable form suction adjustment. High rate of suction makes the plaster, weak, porous and friable. The wall shall not be soaked but only damped evenly before

applying the plaster. If the surface becomes dry in spots such areas shall be moistened again to restore uniform suction. Excessive water leads to failure of bond between the plaster and back ground.

Evenness

Any local unevenness must be levelled, and projections removed to avoid variance in thickness of plaster.

Immobility

Differential movements between the background and the plaster due to moisture change, temperature change, structural settlement, deflection etc., cause cracks.

The major part of such movements shall be allowed to set in before the plaster is applied.

Precaution against Discontinuity in Back Ground

All straight cut groove through the plaster at the junction of wall to ceiling may be provided where directed. Holes left in the wall after removing scaffolding, shall be filled up with respective masonry and the patch plaster up true and in conformity with rest of the wall so that no sign of patch work shows out.

Plastering

The type and mix of water for plastering, the number of coats to be applied, and surface finish of the plaster and the background to which the plaster is to be applied shall be as indicated.

The mortar for dubbing out and rendering coat shall be of the same type and mix.

Dubbing out may be executed as a separate coat or along with the rendering coat.

Plastering operations shall not be started until all necessary fixtures such as doors and window frames, mantle pieces or completed and all pipes and conduits to be embedded have been installed and surface to be plastered have been passed by Project Manager/appropriate government authority appointed by GSCDL.

Protection

All existing work and fittings that are likely to be damaged in the application of plastering shall be protected. Care shall be taken to avoid, as far as possible, the splashing of mortar on to the finish surfaces such as joinery, paint work and glazing, all such splash shall be cleaned off immediately.

Screeds 15x15cm shall be laid vertically and horizontally not more than 2M apart to serve as guides in bringing the work to an even surface.

Plastering shall be done from top to bottom and care shall be taken to avoid joints in continuous surface.

Maintenance of Proper Time Intervals

To avoid breakdown of adhesion

between successive courses, drying shrinkage of first coat shall be allowed to be materially completed before a subsequent coat is applied.

All corners, arched angles, junctions shall be truly vertical or horizontal as the case may be and shall be carefully finished. Rounding or chamfering of corners, arches and junctions shall be carried out with proper

template to the required size. Plastering of cornices, decorative feature, etc. Shall normally be completed before the finishing coat is applied.

In suspending the work at the end of the day, the plaster shall be cut clean to the line both horizontally and vertically.

When recommencing the plastering, the edge of the old work shall be scraped clean and wetted with cement slurry before plaster is applied to the adjacent area. Partially set and dried mortar shall be not be re-tampered for use.

Cleaning on Completion

On completion of work affected by plastering shall be left clean, special care shall be taken while removing any set mortar from glass and joinery, etc., to avoid damaging their surface.

Trueness of Plastering System

The finished plaster surfaces shall not show any deviation more than 4 mm when checked with straight edge of 2 m length placed against the surface.

One Coat Plaster Work

Mortar shall be firmly applied to masonry walls and well pressed into the joints and forcing into surface depression to obtain a permanent bond. The plaster shall be laid a little more than the required thickness and levelled with wooden float. On concrete walls, rendering shall be dashed onto the roughened surface to ensure adequate bond. The dashing of rendering coat shall be done using a strong whipping motion at right angle to the face of walls. The surface shall be finished even and fair, unless indicated to be finished even and smooth. The surface of the dubbing out, if carried out separately, shall be left trough or scored to provide key for the plaster coat.

Two Coat Plaster Work

First Coat: The first coat of specified thickness shall be applied in a manner similar to one coat plaster work. Before the first coat hardens, the surface of cement plaster shall be scored to provide key for second coat. The rendering coat shall be kept damp for at least two days. It shall then be allowed to become thoroughly dry.

Second Coat: Before starting to apply second coat, the surface of the rendering coat shall be damped evenly. The second coat shall be completed to the specified thickness in exactly the same manner as the one coat plaster work.

Water Proofing Plaster

Integral water proofing compound shall be mixed with cement in proportion indicated by weight. Care shall be taken to ensure water proofing material gets well and integrally mixed with cement.

Roofing and Water proofing treatments / drainage:

New roof for the all buildings Social Housing for EWS including fixing of steel tubular trusses, fixing of pre-painted GI roofing sheets with GI fixtures, with the fixtures for ridges and hips and decorative WPC eaves boards based on approved designs and as directed by Project Manager/appropriate government authority appointed by GSCDL. The design should be based on the General arrangement drawing as provided architectural drawings attached in this RFP.

- ccxi. Rooftops shall be painted with bitumen, as per Sikkim PWD Specifications. Suitable type of bitumen as per Sikkim PWD Specifications or CPWD Specifications or relevant IS code shall only be permitted for bitumen coatings of roof top and D.P.C. DPC shall be with conformity to I.S.3067 / I.S.1346
- ccxii. Laying brick bat coba water proofing of average 115 mm thick at terrace using cement mortar 1:3 arranging brick bats according to the slope, adding suitable water proofing compound for water tightness and again providing on top cement mortar 1:3 including addition of water proofing compound and finishing the top with neat cement @ 2.75 kg/m² and preparing the rough surface as per directed.
- ccxiii. Water Proofing for Basement floor and surface: Providing & laying Box type waterproofing treatment to floors and external surfaces of underground structures. The treatment comprises of waterproofing layer, average 100 mm. thick for floors, using two layers of polished kota stones placed diagonally with cut joints Bottom layer of 15 mm. thick 1:3 C.M. bedding with approved waterproofing chemical. 20 mm. to 25 mm. thick rough polished kota stone laid diagonally above the 1st layer with cut joints. Joints shall be sealed by 1:1 C.M. with approved waterproofing chemical. The above two layers shall be laid again, in the same manner as described above. The final layer of 30 mm. thick I.P.S. shall be laid with approved water proofing chemical having desired finish as directed including curing etc. complete on any surface, at all heights. The contractor to give testing for water tightness.
- ccxiv. Checking the leakage & seepage with ponding test & application of approved waterproof compound 2 coats over the roof slab & continued over R.C.C. parapet wall. Coping with 1:4 Cement mortar admixed with approved waterproof compound. Followed by a protection screed (1:1.5:3) in panels of size 2mtr x 2mtr to drain the rain water towards rain water pipe & finally filled the joint groove with Polyurethane sealant of approved make. Complete as per manufacturer specification and direction of Project manager/ appropriate government authority appointed by GSCDL

Note: Excluding cost of concrete.

- ccxv. Cleaning of surface, provision of Sika Swell S2 & Sika Swell A (Acrylic Profile over swellable sealant at construction joints at retaining wall), Providing & applying of Sika Topseal 109hi (2 component based acrylic polymer coating over a coat of primer over PCC followed by protection plaster. Consumption 2.4Kg/sq.m. followed by a protection plaster over a bond coat of Sika Latex (1:4:6).

Note: pressure grouting of cement slurry at joints with expanding grout polymer Sika Intraplast or approved equivalent EP@0.5Kg/50 Kg Cement. Complete as per manufacturer specification and direction of Project Manager/appropriate government authority appointed by GSCDL.

Note: Excluding cost of concrete & plaster.

- ccxvi. Rain water pipes shall be fixed as per Sikkim PWD Specifications and confirm to I.S. 2527
- ccxvii. Execution of top and bottom *khurras* and spouts shall be done as per Sikkim PWD Specifications.
- ccxviii. Unless, otherwise specified, the normal bitumen felt waterproofing treatment shall be executed as per Sikkim PWD Specifications.

- ccxix. Wherever required the water proofing of roofs shall be as per manufactures specifications approved by the Project Manager/appropriate government authority appointed by GSCDL.

Curing

Each coat shall be kept damp continuously for at least two days. Moistening shall commence as soon as the plaster has hardened sufficiently and is not susceptible to injury. The water shall be applied preferably by using a fine fog spray. Soaking of wall shall be avoided and only as much water as can be readily absorbed shall be used. Excessive vaporization on the sunny or windward side of buildings in hot dry weather shall be prevented by hanging matting or gunny bags on the outside of the plaster and keeping them wet.

Neeru Finish

After applying and finishing the under coats i.e., (undercoat + floating coat) as described, and before they set, the finishing coat shall be applied to a thickness of not more than 1.5 mm with specially prepared lime putty i.e., Neeru to which about 5 percent cement has been added.

It shall then be well polished with trowel. While troweling is going on, soil stone powder contained in thin muslin bags shall be dusted over the surface and worked in.

When the surface of outer walls is to be treated with sunk or grooved line work like squares or rectangles, by drawing vertical and / or horizontal lines at intervals, such lines (which may be V-grooved or U-shaped) shall be marked on the floating coat when it is not yet set and neatly finished off in the finishing coat with a wood lath having an edge of requisite thickness and slope on one of its sides.

NOTE: In each case the finishing done shall be uniform all over the surface and to the entire satisfaction of the Project Manager/appropriate government authority appointed by GSCDL. A sample of considerable area shall be first made in consultation with the Project Manager/appropriate government authority appointed by GSCDL and shall be got approved before starting the work.

Curing

Moistening shall be commenced as soon as the plaster has hardened sufficiently and is not susceptible to injury. Soaking of wall shall be avoided and only as much water as can be readily absorbed shall be used.

All plaster work shall be kept damp continuously for a period of 14 days. To prevent excessive evaporation on the sunny or windward side of the buildings in hot, dry weather, matting or gunny bags may be hung over on the outside of the plaster in the beginning and kept moist. Should the mortar of the plaster perish through neglect of watering or for any other default and if the work is not done as specified above, the plaster shall be removed and redone at the contractor's expenses.

Mode of Measurement and Payment

If the average thickness of plaster provided by the contractor is more than what is specified on any account, no extra payment will be made for the same.

- ccxx. The quoted rates shall be per Sq. mt. and shall include:
ccxxi. Erecting, dismantling and removing the scaffolding.
ccxxii. Preparing the surface to receive the plaster.
ccxxiii. Providing cement plaster with specified finish and specified thickness.

- ccxxiv. All labour, materials, use of tools and equipment to complete the plastering as per specification.
- ccxxv. Curing for 14 days.
- ccxxvi. Any grooves, bands, etc., if shown on the drawings or as directed by the Project Manager/appropriate government authority appointed by GSCDL.
- ccxxvii. All lifts and leads.

gg) All wooden frames, steel frames or other fixtures, which are required to be painted or polished subsequently shall be cleaned after the plastering work is completed.

hh) Measurements shall be based on area of plastered surfaces and the rate shall be per Sq. mt. of this area.

For openings, the following principles shall apply:

Area of opening less than 0.5 Sq. mt.: No deductions shall be made for the opening and no additions shall be made for reveals, jambs, soffits, sill etc. Area of opening between 0.5 Sq. mt. and 3 Sq. mt.: No additions shall be made for reveals, jambs, soffits, sills, etc., and deductions shall be as follows;

- ccxxviii. When only one face is plastered, no deductions shall be made.
- ccxxix. When both faces are plastered to the same finish, deductions shall be made for one face only.
- ccxxx. When the two faces are plastered with different finishes deductions shall be made for that face on which the width of reveal is less, but no deductions shall be made on the other side.

Area of opening greater than 3 Sq. mt.: Deduction shall be made for the actual opening and reveals, jambs, soffits, sill etc., shall be separately measured and paid. The quoted rate shall include supply of all materials, labour, scaffolding, plant and equipment, tools and tackle and all other work incidental to the completion of this item as per these specifications and all lead and lifts.

FLOOR FINISHES

Indian Standards

The following I.S. apply to this section;

Table 3: I.S Standards of floor finishes

I.S. NO.	SUBJECT
777 – 1970	Specification for glazed earthenware tiles (First Revision with Amendment No.1)
1237 – 1980	Specification for cement concrete flooring tiles (First Revision)
4557 – 1982	Specification for ceramic unglazed, vitreous acid resistant tiles (First Revision)
8042 – 1978	Specification for white portland cement
5491	Code of Practice for laying in situ granolithic concrete floor topping.

Materials

- ccxxxi. Cement: Cement shall be ordinary portland cement conforming to I.S.269– 1976.
- ccxxxii. White Cement: White cement shall conform to 8042–1978 specification for white portland cement. Wherever is to be used, shall comply with India standard IS: 269 and its colour shall be pure white.
- ccxxxiii. Aggregates: Coarse and fine aggregate and cement concrete and granolithic concrete shall conform to I.S.383 – 1970.

Aggregate for granolithic concrete shall consist of crushed granite, basalt, trap quartzite. The aggregate crushing value shall not exceed 30 percent. The grading of aggregates shall be as given below.

IS sieve Designation	Percentage by weight passing IS sieve		
	Coarse aggregate	Fine aggregate	
		Zone I	Zone II
12.5	90 to 100	-	-
10	40 to 85	90 to 100	90 to 100
4.75	0 to 10	60 to 95	75 to 100
2.36	-	30 to 70	55 to 90
1.18	-	30 to 70	55 to 90
600	-	15 to 34	35 to 39
300	-	5 to 20	8 to 30
150	-	0 to 10	0 to 10

Sand for mortar for laying slabs/ tiles shall conform to I.S. 2116– 1980

Cement Concrete Flooring (Cast In-Situ) Granolithic Concrete Floor

Proportion of Granolithic Concrete

The proportion of the granolithic concrete floor topping shall be 1:1:2 (cement, fine aggregate, Coarse aggregate) by volume mixing, laying, finishing and curing etc., shall be carried out as specified.

Size of Panels

The floor toppings shall be divided into suitable panels. Size of panel is governed by the thickness of floor finish, the type of construction, local condition of temperature, humidity and the season in which flooring is laid. Generally, no dimension of panel shall exceed 4M in case of floor topping laid monolithically with the base concrete, and 2M in case of floor topping laid separately on a hardened base. In case of ground floor, topping panel may synchronize with that of the base concrete. Length of a panel shall not exceed one and half times its breadth. The exact dimensions of the panels shall be as directed by the Project Manager/appropriate government authority appointed by GSCDL.

Form Work to Sides of Concrete Flooring:

Form shall be provided as specified, where glass or aluminum dividing strips are provided formwork may not be provided. The boarding/battens shall be fixed in position with their top at proper level, giving slope where require. The floorings shall butt against the masonry of the wall. Before being laid in position, the form or screed strips shall preferably have coated with thick coat of limewash.

Joints:

Construction joints between base of the floor finish need only be plain, untreated vertical butt joints and shall be placed over any joint in the base.

Laying the Topping

The surface of base concrete shall be thoroughly cleaned of all dirt, loose particles, caked mortar droppings and laitance, if any, by scrubbing with coir or steel wire brush. Where the concrete has hardened so much that roughening of surface by wire brush is not possible, the entire surface shall be roughened by chipping or hacking. Before laying the topping, the surface shall be soaked with water at least for twelve hours and surplus water shall be removed by mopping immediately before the topping is laid in position.

The form shall be fixed over the base concrete dividing it into suitable panels. Before placing the concrete mix for topping, neat cement slurry at the rate of 3 Kg/Sqm shall be thoroughly brushed into the prepared surface of the base concrete just ahead of the finish. The topping then shall be laid, thoroughly tamped or vibrated, the surface floated with wooden float to a fair and even surface. The surface shall be tested and finished as specified.

Finishing the Surface Fair Smooth:

Where an even smooth surface is indicated, the surface, after being floated with a wooden or steel float, shall be finished with a steel trowel. Finishing operations shall start shortly after the compaction of concrete and shall

all
 be spread over the period of one to six hours depending upon the temperature and atmospheric conditions. The surface shall be troweled three times at intervals so as to produce a uniform, hard and close knit surface. Immediately after laying, only just sufficient troweling shall be done to give a level surface. Excessive troweling in the earlier stages shall be avoided as this tends to work a layer rich in cement to the surface. Sometimes after the first troweling and after a duration depending upon the temperature and atmospheric conditions, the surface shall be re-troweled to close in pores in the surface, and to bring to surface and scrap off any excess water in concrete laitance (it shall not be troweled back into the topping). The final troweling shall be done well before the concrete has become too hard but at such a time the considerable pressure to make any impression on the surface. Spreading and troweling of a rich mix of dry cement and fine aggregate on the surface shall not be permitted. Where the surface is to be finished with a steel trowel using extra cement, it shall be clearly indicated.

Vacuum Dewatering Method and Power Trowelling Method with Skim Floater Finish to Concrete Flooring

- ccxxxiv. Cement concrete shall be laid between steel forms acting as a stop end and also rail to be used for surface vibration. The preparation and laying of concrete as per para 3.4.5 & 3.4.6. Thickness and mix of the concrete as indicated.
- ccxxxv. The concrete thus laid shall be vibrated with a poker vibrator. During poker vibration, proper compaction of coarse aggregate, fine aggregate and cement shall be obtained. The surface will be then finished in level with the help of surface vibrator to give a dense level surface of concrete.
- ccxxxvi. Vacuum de-watering method will be used to remove excess water from the laid concrete and filter pad and suction mat shall be laid on the freshly laid concrete which will not allow cement paste to flow out, and the suction pump are then started immediately to remove the excess water. The suction time normally is 20 to 30 minutes. This vacuum process will enable to remove 15 to 25 percent of water content and making the surface hard enough to enable to carry the floating operation.
- ccxxxvii. The top surface of the removal of the mat shall be floated with a mechanical skim floater with troweling blade to enable the top surface to grind and give a uniform water resistance surface on top. Under no circumstances neat cement be sprinkled directly on concrete surface to absorb bleed water as surface scaling may occur later. Similarly, water should not be applied between troweling operation as it may cause surface weakness. Minimum two passes shall be carried out.

Curing

- ccxxxviii. Immediately after the flooring surface is finished, it shall be protected from rapid drying and strong sunlight. As soon as the surface has hardened sufficiently to prevent damage to it, it shall be kept continuously moist for at least 15 days by means of wet gunny bags or 50 mm thick layers of damp sand spread over the surface or pooling water on the surface. During this period the flooring shall not be exposed to any traffic. Regular traffic on the floor shall be allowed only after 28 days.
- ccxxxix. Mode of Measurement: Flooring shall be measured in square meter basis (m²) length and breadth shall be measured between the finished faces of skirting, dado or wall plaster as the case may be

correct to a cm. No deduction shall be made up to 0.050 Sq. mt. No extra shall be paid for laying the floor at different levels.

- ccxl. Skirtings shall be paid on running meter basis and shall be measured not between the finished faces. The rates shall include cost of all materials and labour and shuttering involved in the operations described above.

Glazed Earthenware/Tiles/Ceramic Tile Flooring, Dado and Skirting

Glazed earthenware tiles shall conform to I.S. 777-1970, specification for glazed earthenware tiles. When fractured they shall appear fine grained in texture, dense and homogeneous. The tiles shall be flat true to shape, sound and free from flaws and other manufacturing defects. The top surface of the tiles shall be glazed. The underside of the tiles shall be free from glaze in order that the tiles may adhere properly to the base. The sides of the tiles shall be preferably free from glaze, if unavoidable, glazes shall be permitted provided that number of edges with complete glaze is not more than one and glaze present in remaining three edges not exceed 15 percent of the surface area of the edge. The glazes shall be uniform in quality and shall be free from welts, chips, craze, specks, crawling or other imperfections, detracting from appearance when viewed at a distance of one meter. The glazes shall be either glossy or matt, as directed and white in colour except in the case of coloured tiles when the tint, shade and finish shall be as indicated. Tiles shall be of sizes and thicknesses as indicated.

IS – 1443: Laying and finishing of C.C. flooring tiles.

Types of Flooring Generally used

- ccxli. Floorings and Dados: Mosaic flooring with conformity to I.S. 2114. Various types of flooring and dados shall be executed as per Sikkim PWD Specifications, as detailed below:

Table 4: Flooring and Dados Specifications

S. No.	Item
1	White glazed ceramic Tile flooring
2	Marble flooring
3	Polished kota stone flooring
4	Rough Polished kota stone flooring
5	Vitrified Tile flooring
6	Granite Stone flooring
7	Ironite flooring/Cement Concrete Flooring with Metallic Hardener Topping
8	Granite Tile flooring
9	Trimix flooring

- ccxlii. Sal Wood: The decking material will have planks of natural Sal Hard Wood (Imported or Local) with minimum thickness of 50mm and installed by joining in different sizes as flooring on decks on confirming IS Codes on approval of the Project Manager/appropriate government authority appointed by GSCDL.
- ccxliii. Cement Concrete Tile: Supplying, fitting and fixing in position 25mm thick cement concrete tile of Ultra category-1/Eurocon or approved equivalent type of approved make, quality, color and size in all floors at all height on 20mm thick bed of cement mortar of mix (1:4) laid in proper slope and gradient grouted with neat white cement slurry with required quantities of pigments of approved marks watering and curing for 21 days, including cost, conveyance, loading, unloading, royalties and taxes of all materials, cost of all labour,

sundries, T&P required for the work complete in all respect as directed by the Project Manager/appropriate government authority appointed by GSCDL.

- ccxliv. Vitrified Tile Flooring: Providing vitrified tile flooring using double charged vitrified tiles of premium grade of Johnson/Kajaria/Asian/Somany/Rak/Nitco equivalent make having thick of 10mm conforming to IS 13756 of 800mmx800mm/ 600mmx600mm colored / printed series (homogeneous) of approved quality, color in floors, treads on steps and landings in all floors at all height on 20mm thick bed of cement mortar of mix (1:4) laid in proper slope and gradient with screened and washed sharp sand for mortar and grouted with epoxy grout with required quantities of pigments of approved marks to match the shades of the vitrified tile if required watering and curing for 21 days, including cost, conveyance, loading, unloading, royalties and taxes of all materials, cost of all labour, sundries, T&P required for the work, complete in all respect as per specification and direction of Project Manager/appropriate government authority appointed by GSCDL.
- ccxlv. Vitrified Tile Skirting: Supplying, fitting and fixing of double charged vitrified tiles in skirting of premium grade of Johnson/Kajaria/Asian/Somany/Rak/Nitco or approved equivalent make having thickness of 10mm conforming to IS 13756 of 800mmx800mm /600mmx600mm colored / printed series (homogeneous) of approved quality, color of approved quality and size in dadoes in all floors at all heights and riser of steps on 12mm thick cement plaster (1:3) using screened and washed sharp sand for mortar with grouted Epoxy grout to match the shade of the tiles including cost, conveyance, loading, unloading, royalties and taxes of all materials, cost of all labour, curing -sundries and T&P, etc. required for the work complete as per specification and direction of Project Manager/appropriate government authority appointed by GSCDL.
- ccxlvii. Ceramic Floor Tile: Providing 30cmx30cm/40cmx40cm size special plain/printed series ceramic floor tiles of premium grade of Kajaria power line series/Somany/Johnson/Asian or equivalent type of approved make having thickness 7mm to 8mm, conforming to IS 13755 for ceramic tile flooring of approved quality, color and size in floors, treads on steps and landings in all floors at all height on 20mm thick bed of cement mortar of mix (1:4) laid in proper slope and gradient, grouted with neat white cement slurry jointing the tile with neat white cement slurry mixed with required quantities of pigments of approved marks to match the shades of the ceramic tile if required , watering and curing for 21 days, including cost, conveyance, loading, unloading, royalties and taxes of all materials, cost of all labour, sundries, T&P required for the work, complete in all respect as directed by the Project Manager/appropriate government authority appointed by GSCDL.
- ccxlviii. Ceramic Wall Tile: Providing 30cmx45cm size special plain/printed series edge cut ceramic wall tiles of premium grade of Kajaria digital highlighter/Somany/Johnson/Asian or equivalent type of approved make having thickness 6.5mm to 6.7mm conforming to IS 13753 of approved make & shade in Dadoes over 12mm thick cement plaster 1:3 (1 Cement: 3 Coarse sand) finished with modular pointing in white cement & pigment to match the shade of the tiles including cost, conveyance, loading, unloading, royalties and taxes of all materials, cost of all labour curing sundries and T & P etc. required for the work etc. complete as per specification and direction of Project Manager/appropriate government authority appointed by GSCDL.

ccxlvi. Granite Flooring: Providing 20mm thick avg. and above 0.40 Sqm size granite tile flooring in staircase of approved quality, color and size in floors, treads on steps and landings in all floors at all height on 25mm thick bed of cement mortar of mix (1:1) laid in proper slope and gradient with screened and washed sharp sand for mortar and grouted with neat white cement slurry jointing the tile with neat white cement slurry mixed with required quantities of pigments of approved marks to match the shades of the granite tile if required watering and curing for 21 days, including cost, conveyance, loading, unloading, royalties and taxes of all materials, cost of all labor, sundries, T&P required for the work including rubbing mechanically and wax polishing etc. complete in all respect as per specification and direction of Project Manager/appropriate government authority appointed by GSCDL.

Polished kota stone flooring shall be carried out as Sikkim PWD building Specifications. Polished kota stone shall be as per direction of Project Manager/appropriate government authority appointed by GSCDL. Dados: Polished kota stone or Vitrified tile dado shall be executed as per the relevant specification of Sikkim PWD building Specifications. Skirting (3/4" thick) of Polished kota stone shall be executed as per the relevant specification of Sikkim PWD building Specifications. Granite Stone shall be executed as per the relevant specification of Sikkim PWD building Specifications. Vitrified tile shall be executed as per the Sikkim PWD building Specifications. Ironite flooring/ Cement Concrete Flooring with Metallic Hardener Topping shall be executed as per the relevant Sikkim PWD building Specifications. Granite tiles shall be executed as per Sikkim PWD building Specifications. Trimix flooring shall be executed as per Sikkim PWD building Specifications of pavement in material Specification.

Tolerances

Facial dimensions: Thelengthof allthefour sidesof tilesshall be measured to the nearest 0.1mm.The average value shallnotvary more than+or-0.8 mmfrom the dimensionofthe nominalsize.The variation of the individualdimensionfrom the average value shallnotexceed +or-0.5mm.

Tolerance onthickness +or-0.5 mm.

Trueness of Shape:

Squareness:Anyvariationfromrightangleinanglecontainedbyanytwoandjoiningsidesshallbelimited,so thatifabuilderSteelSquareisplacedagainsttheangle,the distancebetween theinner edgeofthesquare and the adjacentside of thetile shallnotbe more than0.5 mm per100mm.

Warpage:

Thetileswhen tested for warpage on the diagonal shallnothavewarpage exceedingthevalue specified below.

Size of tile	Warpage
99 x99 mm	+ or- 0.5 mm- 0.3 mm
149 x149 mm	+ 0.7 mm- 0.4 mm

Performance Requirement

- ccxlix. **Water absorption:** The average water absorption of the tile when tested and evaluated shall exceed 18 percent.
- ccl. **Crazing:** Tiles when tested for crazing shall satisfy the requirement.
- ccli. **Impact strength:** Tiles when tested for impact strength shall not have a value less than 0.020 Kg fm/cm.
- cclii. **Chemical Resistance:** When tested the glazed surface of tiles having a white/Cream coloured glossy glaze shall show no deterioration.

Bedding

Bedding over which the glazed tiles shall be laid as indicated and shall not be less than 10 mm at any place. Mix of bedding layers should be as specified. Tiles shall be soaked in water before laying.

Laying

Bases shall be cleaned and wetted. The bedding shall then be laid evenly over the surface, tamped and corrected to desired levels and allowed to harden enough to offer a rigid cushion to tiles. Before laying the tiles, cement slurry of honey like consistency 3 Kg/Sq. mt. shall be applied over the bedding. At a time, area to accommodate about 20 tiles shall be applied with cement slurry. Tiles shall then be washed clean and fixed in the grout one after the other. Each tile being gently tapped in its position till it is properly bedded and in level and line with adjoining tiles. The joint shall be as thin as possible but not exceeding 1.5 mm wide.

In the case of skirting and dado, the wall surface shall be covered with about 10 mm thick plaster of cement and sand mortar 1:3 and allowed to harden. The plaster shall be roughened with wire brushes or by scratching diagonally. The back of the tiles shall be buttered with cement paste and set on bedding mortar. The tiles shall be gently tapped in position one after the other. Top of skirting or dado shall be truly horizontal and the joints vertical or as per required pattern.

Jointing and Finishing

The joints shall be raked to a depth of 5 mm and all dust and loose mortar removed. Joints shall then be flush pointed in white cement or in coloured cement in the case of coloured tiles. The surfaces shall be cured for seven days and then wash clean.

Mode of Measurement: Payment will be on Sq. mt. basis. Rates shall include cost of all materials, labour and shuttering involved in all the operations.

Kota Stone Flooring

Stone Slabs:

The slab shall be of selected quality, hard, sound, dense and homogeneous in texture, free from cracks, decay, weathering and flaws. They shall be hand or machine cut to the requisite thickness as indicated and they shall be of uniform colour.

The slab shall have on top (exposed) face polished before being brought to site. Before starting the work, contractor shall get the samples of slabs approved by Project Manager/appropriate government authority appointed by GSCDL..

Dressing of Slabs:

Every slab shall be cut to the required size and shape and fine chisel dressed on the site to the full depth so that a straight edge laid along the side of the stone shall be in full contact with it. The sides (edges) shall be table rubbed with coarse sand or machine rubbed before paving. All angles and edges of the slabs shall be true, square and free from chippings and the surfaces shall be true and plain. For staircase treads, single piece slab to full length and width of tread shall be provided. The nosings shall be rounded off and two parallel grooves of ten by ten (10mm x 10mm) immediately behind the nosing edges shall be provided as per drawing to avoid skidding.

Preparation of Surface and Laying:

Subgrade concrete or the R.C.C. slab on which the slabs are to be laid shall be cleaned, wetted and mopped. The bedding for the slab shall be with cement mortar 1:4 (one cement: four coarse sand). The thickness of the screed shall be as indicated.

The slab shall be laid in the following manner; Mortar of the specified mix shall be spread under the area of each slab, roughly to the average thickness as indicated. The slab shall be washed and cleaned before laying. It should be laid on top, pressed, tapped with wooden mallet and brought to level with the adjoining slabs. It shall be lifted and laid aside. The top surface of the mortar shall then be corrected by adding fresh mortar at hollows. The mortar is allowed to harden and cement slurry of honey like consistency shall be spread over the same at the rate of 4 Kg of cement per Sq. mt. The slab to be paved shall be lowered gently back in position bedded in level. Subsequent slab shall be laid in the same manner and joints between adjacent slabs shall be thin as possible and run in straight line. After each slab has been laid, surplus cement grout coming out of the joints of slab shall be cleaned off. The surface of the flooring as laid shall be true to levels, lines and shapes as instructed by Project Manager/appropriate government authority appointed by GSCDL.. The slab shall be matched as shown in drawings or as instructed by the Project Manager/appropriate government authority appointed by GSCDL.

Slabs, which are fixed in the floor adjoining the wall shall enter not less than twelve (12) mm under the plaster, skirting or dado. The junction between wall plaster and the floor shall be finished neatly and without waviness.

Curing, Polishing and Finishing

The floor shall be kept wet for a minimum period of seven (7) days. The surface shall thereafter be ground evenly with machine fitted with grade blocks (No. 120). The final grinding with machine fitted with the finest grade grit blocks (No. 320) shall be carried out the day after the first grinding described above or beforehand in g over the floor, as ordered by the Project Manager/appropriate government authority appointed by GSCDL.

For small areas of where circumstances require, hand polish may be permitted in lieu of machine polishing after laying. For hand polishing the following carborundum stone shall be used.

ccli. First Grinding – Medium stone (No. 8)

ccliv. Final Grinding – Fine grade (No. 120)

In all other aspects, the process should be similar as for machine polishing.

After the final polish, oxalic acid shall be dusted over the surface at the rate of thirty-three (33gms) per Square meter sprinkled with water and rubbed hard with pad of woolen rags. The following day the floor be wiped with moist rag and dried with a soft cloth and finished clean.

If any slab is disturbed or damaged, it shall be refitted or replaced, properly jointed and polished. The finished floor shall not sound hollow when tapped with wooden mallet.

Polished Slab Granite Flooring

Materials

Polished granite slab shall be machine cut. Machine cut slab shall have fine tooled dressing on all sides to full depth.

Laying Stone Slabs

Slab shall be washed clean before relaying. The bedding mortar of the specified mix shall be spread under each

slab, slab shall be then laid on top, pressed so that the hollows underneath get filled and surplus mortar works up through the joints. The slab should be tapped with wooden mallet and brought to level and close to adjoining slabs with thickness of joints not exceeding 1.5 mm. After laying each slab surplus mortar on the surface of the slabs shall be cleaned off and joint finished flush. Subsequent slabs shall be laid in the same manner. The joint shall be left raked out uniformly to a depth not less than 10 mm, when the mortar is still green. The surface of the flooring laid, shall be true to levels as directed by the Project Manager/appropriate government authority appointed by GSCDL. Slabs, which are fixed in the floor and joints shall be not less than 12mm under the plaster, and floor shall be finished neatly and without waviness.

The flooring shall be cured for Fourteen days. The finished floor shall not sound hollow when tapped with wooden mallet.

Mode of Measurement

Measurement shall be on Sq. mt. basis. The rate shall include cost of all materials, labour and shuttering involved in all the operations.

Cement Concrete Flooring Tiles

Cement concrete flooring tiles shall be of heavy duty floor tiles as per I.S. 1237-1980.

Materials:

Cement

Cement used in the manufacture of tiles shall be ordinary Portland cement conforming to I.S. 269-1976.

Aggregate

Aggregates used in the backing layer of tiles shall conform to requirement of I.S. 383-1970. For the wearing layer unless otherwise specified aggregate shall consist of marble chips or any other natural stone chips of similar characteristics and hardness, marble powder or dolomite powder or mixture of the two.

Manufacture

Cement concrete flooring tiles shall be manufactured from a mixture of cement, natural aggregate and coloring material where required by pressure process. During manufacture, the tiles shall be subjected to a pressure of not less than 140 Kg per Sq. cm.

The proportion of cement to aggregate in the backing of the tiles shall not be leaner than 1:3 by mass. On removal of mold, the tiles should be kept in moist condition continuously for such a period that would ensure their conformity to the requirements of the I.S. standards. Tiles shall be stored under cover.

Dimensions

The size of cement concrete floorings shall be as follows;

Length (MM)	Breadth (MM)	Thickness (MM)
200	200	20
250	250	22
300	300	25

Tolerances

Tolerances are length or breadth of tiles shall be + or - 1 mm.

Tolerance on thickness shall be +5mm. In addition, the difference in thickness between the thickest and thinnest tile in the sample shall not exceed 3 mm. Thickness of wearing layer for heavy duty cement tiles shall be 6mm.

General Quality

Unless otherwise specified the tiles shall be supplied with initial grinding and grouting of the wearing layer. The wearing layer of the tiles shall be free from projections, depressions, cracks, holes, cavities and other blemishes. The edge of the wearing layer may be rounded.

Finish

The colour and texture of wearing layers shall be uniform throughout its thickness. No appreciable difference in appearance of the tiles, from the point of view of colour aggregate, its type and its distribution on the surface of wearing layer shall be present.

Physical Requirements

Flatness of the Tile Surface

The tiles when tested, the amount of concavity and convexity shall not exceed 1 mm.

Perpendicularity

When tested the longest gap between the arm of the 'square' and the edge of the tile shall not exceed 2 percent of the length of the edge.

Straightness

When tested the gap between the thread and plane of the tile shall not exceed 1 percent of the length of the edge.

Water Absorption

When tested the average percentage of water absorption shall not exceed 10.

Wet Transverse Strength

When tested the average wet transverse strength shall not be less than 30 Kg. Per Sq.cm.

Resistance to Wear

When tested the wear shall not exceed the following value;

cclv. For general purpose tiles

- ii) Average wear 3.5 mm
- jj) Wear on individual specimen 4.0 mm

cclvi. For heavy duty floor tiles

- kk) Average wear 2.0 mm
- ll) Wear on individual specimen 2.5 mm

Cement Mortar Screed

The screed bed for laying cement concrete tile shall be cement and sand mortar 1:6 in the case of floors and cement and sand mortar 1:3 in the case of skirtings and dados. The base shall be cleaned of all scum, laitance or plaster droppings or any other loose foreign matter. It shall be properly wetted without allowing any water pools on the surface. The mortar shall then be evenly spread over the base for two rows of tiles and about 3 to 5 metres in length. The top of mortar shall be kept rough, so that cement slurry can be absorbed. The thickness of the bedding shall be not less than 15 mm in any place.

Laying of Tiles

Laying of tiles shall commence by the time the bedding becomes sufficiently hard to offer rigid cushion for the tiles. Neat cement slurry of honey like consistency shall be spread over the mortar bed, over such an area at a time as would accommodate about 20 tiles. The tiles shall be fixed in this grout one after the other, each tile

being gently tapped with a wooden mallet till it is properly bedded and in level with the adjoining tiles. The joint shall not exceed 1.5mm width.

After the tiles have been laid in a room or the days laying work is completed, the surplus cement slurry and the joints shall be cleaned and washed fairly deep with the help of broomstick. It shall be seen that the cement slurry is cleaned before it sets hard.

The day after the tiles have been laid, the joints shall be filled with cement grout of the same shade as the colour of the matrix of the tiles.

Tiles which are fixed in the floor adjoining the wall, shall go about 10mm under the plaster, skirting or dado. For this purpose, the wall plaster may be left and finished by about 50mm above the level of the proposed finished flooring, skirting or dado and the unfinished strip may be plastered later on after the tiles are fixed.

After fixing, the flooring shall be kept moist and allowed to mature undisturbed for seven days, so that the bedding and joints set properly. After this it may be used for light traffic. Heavy traffic shall not be allowed on the floor for at least fourteen days after fixing the tiles.

Wherever big areas of floor are to be laid, the level of the centre portion of the floor shall be kept about 10 mm higher than the level marked at the wall.

Grinding and Polishing

Grinding and polishing of the tiles shall be commenced only after the floor as well as the joints are properly set but in no case earlier than fourteen days of laying.

Grinding shall preferably be done using a machine except for skirting and dados, Chequered or grooved tiles shall be polished by hand.

For grinding tile flooring, the first grinding shall be with carborundum stone of 48 to 60 grit. When the floor is rubbed even the chips show uniformity it shall be cleaned with water making bare pinholes. Grouting in the same shade is then briskly applied so that all pinholes are properly filled in. The grout shall be kept moist for a week for proper setting. Thereafter the second grinding operation with carborundum stone of 120 grit is commenced. The floor is grouted again to fill in fine pin holes. After curing for a week, the floor is left with this protective film till other works are completed. Final grinding is done with carborundum of 220 to 350 grit using plenty of water. When surface is rendered smooth it is washed with water. Afterwards oxalic acid powder is vigorously applied with machine fitted with Hessian bobs to bring out shine. Floor is then washed clean and dry linen applied to suck in moisture.

Where indicated, wax polish shall finally be applied mechanically with clean Hessian bobs. Superfluous wax is mopped-up with saw dust to prevent slipperiness. Saw dust may be allowed to remain on the surface till occupation. This will protect the surface and help to increase luster. When saw dust is spread, water should not be spilled as this is likely to leave stain on the polished surface.

In the case of plain cement and coloured cement tiles, the process of polishing shall be the same as described for terrazzo tile except that initial grinding with carborundum stone to 48 to 60 grit is not necessary.

Mode of Measurement

Payments shall be on Sq.mt. basis. The rate shall include cost of all materials, labour and shuttering involved in all the operations mentioned above.

JOINERY

Indian Standards

The following IS applying to this section: -

IS No.	Subject
2202- Part I 1983	Specification for wooden flush door shutters (solid core type) Part I Ply wood face panels (Fourth revision)
287- 1973	Recommendation for maximum permissible moisture content of timber used for different purpose (second revision with Amdt. 1)

Materials

- cclvii. Timber for door frames (First class teak wood)
- cclviii. Timber shall be of good quality, well-seasoned, fairly uniform in colour and texture and free from blemishes, hollow pockets and loose knots. Non coniferous sawn timber (hardwood) shall be free from bow, any kind of decay, live insect attack, spiral or twisted grains, splits across the grains, spring, warp, cup shake.
- cclix. Timber shall be obtained either in cut sizes or as sleepers and cut to required size well in advance of commencement of fabrication and stacked at site of work in a suitable manner for seasoning

Timber for joinery purpose shall conform in general to Sikkim PWD Specifications / I.S. 7452/82 & IS 4021/1995.

Seasoning

Timber shall be seasoned, before being planned to the required sizes to a moisture not exceeding the specified maximum moisture content.

Moisture Content

The maximum permissible moisture content of timber for different uses, whether kiln or air seasoned, shall not exceed the limits laid down in IS 287- 1973. Recommendation for maximum permissible moisture content of timber used for different purpose.

Tolerances

Seasoned timber (whether air or kiln dried) shall be deemed to conform to the moisture content requirements if the average moisture content of all samples from a given lot is within + 3 percent and the moisture content of individual sample is within + 5 percent of the maximum permissible content for the particular end use and locality.

Workmanship

All members of the timber frames shall be straight without any warp or bow, and shall be exactly at right angles, which shall be checked from the inside surface of the respective members. Frame shall have smooth well planned surfaces except the surface touching the wall, lintels, sills etc.,

which may be left clean sawn, unless it is required for straightening up or to obtain over all sizes. Rebates, rounding's and molding etc., shall be done before the members are jointed into frame. Timber frames shall have dovetail joints. The jam post shall be through tenoned into the mortices of the transom to fill width and the thickness of tenoned shall not be less than 15 mm. The tenons shall be closely fitted into the mortices without any wedging or filling and shall be pinned with hard wood or bamboo dowels not less than 10 mm dia. The depth of the rebate in the frames for housing the shutter shall be 15 mm. The joints before putting together shall be glued with synthetic adhesive conforming to I.S. 851 of 1978 or 4835-1979.

All door frames shall be clamped together so as to square and flat before being built in. Each assembled door frame shall be fitted with temporary cross batten. The faces of frame abutting the wall, lintel, cill etc., shall be given two coats of hot tar before fixing, unless otherwise indicated.

Fixing Oo Choukaths and Frames

Timber frames of door shall be installed by "built in method". Unless indicated to be installed by prepared opening method. Precaution shall be taken to fix the door frames so as to take care of final floor level, and whether shutter opens inside or outside. Hold fast shall be tightly fixed to the frame by means of bolts or screws as indicated, the bolt hole in the frame being plugged suitably and flush neat unless otherwise indicated.

Built In Method

Masonry in the wall shall be built after installation of frames, so that the hold fast and pins, if any, at the bottom or well anchored to them. Suitable arrangements shall be made to hold the frame in rectangular shape and prevent warping and distortion of frames during construction. Usually one cross batten at the middle, one cross batten at the bottom and two cross battens diagonally will be necessary to hold the frame rectangular.

Pressed Steel Frames of Doors

Steel frames for wooden shutter shall be pressed out of commercial mild steel sheets of 1.25 mm thickness and shall comply with the requirements of I.S. 4351-1976, specification for steel door frames. The size, type (profile) and dimensions of the frames as indicated. The tolerance over the profile size shall be + or - 2 mm. Steel frame shall be of approved make.

Flush Door Shutters

Flush door shutters shall be solid core type with block board coat, as indicated, and shall conform to I.S. 2202 (Part I) - 1983, specification for wooden flush door shutters (solid core type) Part-I plywood face panels. Except with regard to the sizes of shutter which shall be as indicated. Flush door shutter shall be non-decorative (commercial) type. Flush door shutters internally lipped, internal lipping may be provided separately or as one piece with the frame. The width of frame including lipping shall not be less 50 mm. Where separate lipping is specially desired, it shall be as indicated. Internal lipping shall have total depth of not less than 25 mm, joints shall not be permitted in lipping.

In the case of doubled leaved shutters, rebating shall be splayed or square as directed. Where separate lipping is indicated the depth of lipping at the meeting of stiles shall not be less than 35 mm.

Flush door shall be free from twist, or warp in plane and all the four edges of the door shutters shall be square. Both the faces of the door shutter shall be sanded to a smooth even texture.

Tolerance on nominal thickness shall be + or – 1.2 mm. Thickness of shutter shall be uniform through the variation not exceeding + or – 0.8 mm when measured at any two points.

Builders Hardware

Aluminum Butt Hinges

Hinges shall be well made, shall be free from flaws and defects. All hinges shall be cut clean and square. The hole for the hinge pin shall be central and square to the knuckles/boss. All sharp edges and corners shall be removed. The movements of hinges shall be free, easy and square and working shall not have any play or shake. The hinge pin shall fit inside the knuckles firmly notched and properly finished, so as to not to allow any play or shake. All screw holes shall be clean counter sunk, suitable for counter sunk head wood screws. Aluminum butt hinges shall comply with I.S. 205 – 1978, specification for nonferrous metal butt hinges, and shall be of extruded aluminum alloy. Aluminum hinges shall be anodized. The hinge pin shall be aluminum alloy, shall be hard, anodised and sealed with oil, wax or lanolin. Aluminum butt hinges shall be of the size indicated.

Mortice Lock (Vertical Type)

These shall conform to I.S. 2209 – 1976, specification for mortice lock (vertical type). These shall be brass or aluminum as indicated. Number of levers shall also be as indicated.

Handles

These shall conform to I.S. 208 of 1979, specification for door handles. Handles shall be of cast aluminum, aluminum alloy fabricated handles. Door handles shall be finished smooth, when the grip portion of the handle is jointed with the base piece by mechanical means, the arrangements shall be such that the assembled handle shall have adequate strength. Aluminum handles shall be anodised.

Aluminum Tower Bolt

Shall conform to I.S. 204 (Part-II) – 1978, specification for tower bolts (Part-II) nonferrous metal. Aluminum tower bolts shall be of extruded section of aluminum alloy, shall be of barrel bolts shall have a knob integral with bolts and of robust construction. The type and size as indicated.

Aluminum Alloy Sliding Door Bolt (Aldrop)

These shall comply with I.S. 2681-1979 specification for nonferrous sliding door bolt for use with pad lock. Aluminum alloy sliding door bolts with hasp, staple and fixing clips of sheet, casting or extruded sections or casting of aluminum alloy.

The sliding door bolt shall have smooth sliding action. The hasp, when not cast integral with the bolt, shall be properly secured to the bolt. Sliding bolt shall be provided with fixing bolts. Aluminum bolts shall be anodised.

Workmanship

All builder's hardware shall be fixed to joinery in a secure and efficient manner. Special attention shall be given to the size and fixing of screws to ensure that the screws are driven (and not hammered) tight and heads of the screw do not protrude. All hinges shall be counter

sung into the edge of the timber joinery and frames to a depth equal to the thickness of the leaf of hinge.

METAL WORKS - ANODISED ALUMINUM DOORS, WINDOWS AND VENTILATORS

Material

Aluminum sections incorporated in doors, windows, ventilators shall conform to designation 63400 given in I.S. 737-1986.

Workmanship

- cclx. Minimum average thickness of anodizing (coating of anodizing) on all aluminum section and fittings shall be 15 microns and shall conform to I.S. 1868-1983.
- cclxi. Testing of anodizing coating shall be in accordance with I.S. 5523-1983.
- cclxii. Fixing of frames, shutters shall be as per manufacturer's instructions.
- cclxiii. PVC protected sheeting shall be used while fixing the frame of doors/windows and ventilators to avoid damages, scratches etc.

Glazing

- cclxiv. Sheet glass for glazing shall conform to I.S. 2835-1977, specification for transparent sheet glass, and shall be of the quality.
- cclxv. "A" Quality or selected quality (SQ) for selected glazing/where indicated. b. "B" Quality, ordinary quality (OQ) for glazing purpose.
- cclxvi. Sheet glass shall be flat, transparent and clear, as judged by the naked eye, it may however, possess a light tint when viewed edge wise. It shall be free from cracks and other defects.
- cclxvii. Tolerance on the thickness of glass sheet shall be as under.

Nominal thickness	Tolerance
2.0, 2.5, 3.0 & 4.0 mm	+ or – 0.2 mm
4.0, 5.5 & 6.3 mm	+ or – 0.3 mm

Cleaning of Glazing

Glass shall be washed with warm water and soap or mild detergent followed by clean water rinse and dried with cloth or wash leather. Glass with broken or textured surface shall be cleaned with stiff plastic or bristle brush. For removing any obstinate dirt, glass shall be polished with whiting in water or spirit. Organic solvents may be used for special purpose such as petrol or benzene for removing tar, turpentine for paint that as not dried hard and paraffin for grease. The solvent shall be carefully cleaned off the glass afterwards. Plaster or mortar splashes on the glass shall be removed with thin razor blade.

Frosting or Obscuring

The grinding of glass shall be done uniformly and evenly as to avoid any patchy work. The ground glass shall be thoroughly cleaned so that does not catch stains.

Metal Rolling Shutters and Rolling Grills:

The following I.S. shall apply

I.S. NO.	SUBJECT
6248-1979	Specification for metal rolling shutters and rolling grills.

Types of Shutters and Applicable Sizes:

Rolling shutter shall be supplied in the following alternative types based on different methods of operation. The size range applicable to each type is as follows.

- mm) Self-Coiling type (Push and pull type or manual type): It shall be used up to a maximum of 8 Sq. mt. clear area without ball bearings and up to a clear area of 12 Sq. mt. with ball bearings.
- nn) Gear operated type (mechanical type): It shall be fitted with ball bearings, It shall be used up to a maximum of about 25 Sq. mt. clear area, the rolling shutter is operated by a bevel gear box and crank handle and up to a maximum of about 35 Sq. mt. clear area.
- oo) Electrical operated type: It shall be used up to a maximum of 50 Sq. mt. clear area.

Materials

Cold – Rolled Steel Strips

Cold rolled Steel strips used for rolling shutters lath section shall conform to IS 4030-1973, specification for cold rolled carbon steel strips for general engineering purposes, First Revision.

Mild Steel Section

Mild steel sheets and plates used for manufacturing the guide channels, brackets and lock plate shall be of hot rolled steel of thickness less than 3.15 mm and shall be free from defects and edges cleanly sheared.

Steel Pipes

Mild steel pipes used for the suspension shaft of the roller shall be heavy duty pipe suitable for mechanical purpose and shall conform to I.S. 1161-1968, specification for steel tubes for structural purposes (Second Revision).

Cast Iron Castings

Cast iron castings used for roller pulley wheels, U-clamps and bevel gears shall be free from blow holes, surface defects such as cracks, burns etc., and shall conform to grade 15 of I.S. 210 of 1970, specification for grey iron castings (Second Revision).

Springs

Springs used in the roller for counter balancing the rolling shutter shall be made either from high tensile spring steel wire or flat spring steel strip.

Malleable Cast Iron

Malleable Cast Iron used for clips shall conform to I.S. 2108-1962.

Aluminum Alloy Sheets

Aluminum Alloy sheets used for curtain in case of rolling grills shall conform to I.S. 737 – 1974.

Aluminum Alloy Extrusions

Aluminum Alloy extrusions for the components of rolling shutters of aluminum shall be of I.S. 733 – 1975.

Sal Wood Frame

Providing and fixing in position well dressed, naturally seasoned sal wood rebated frames of size 125mmx63mm to doors including two coats of hot bitumen applied to rear of frame in contact with masonry or concrete surface fixed with MS hold fast of 35x5mm embedded in cement concrete blocks 15x10x10cm of 1:3:6 (1 cement : 3 coarse sand : 6 graded stone aggregate 20mm nominal size) complete with all materials, labors, T & P including cost, conveyance, loading, sundries required for the work etc. complete in all respect confirming to I.S. 7452/82 & IS 4021/1995as directed by the Project Manager/appropriate government authority appointed by GSCDL.

PVC Door & Frame

Providing and fixing factory made PVC door frame of size 50x47mm with a wall thickness of 5mm rigid PVC foam sheet, mired at corners and jointed with 2 nos of 150mm long brackets of 15x15mm MS square tube, the vertical door frame profiles to be reinforced with 19x19mmsquare tube of 19 gauges. The door frame to be fixed to the wall using MS screws of 65/100mm size. PVC door shutter consisting of frame made out of MS tubes of 19-gauge thickness and size of 19x19mm for style and 15x15mm for top and bottom rails. MS frame shall have a coat of steel primers of approved make and manufacture. MS frame covered with 5mm thick heat molded PVC C channel of size 30mmthickness, 70mm width out of which 50mm shall be flat and 20mm shall be tapered in 45-degree angle on both side forming styles and 5mm thick, 95mm wide PVC sheet out of which 75mm shall be flat and 20mm shall be tapered in 45 degree on the inner side to form top and bottom rail and 115mm wide PVC sheet out of which 75mm shall be flat and 20mm shall be tapered on both sides to form lock rail. Top bottom and lock rails shall be provided with both side of panel 10mm (5mmx2) thick, 20mm wide cross PVC sheet be provided as gap insert for top rail and bottom rail. Paneling of 5mm thick of both side PVC sheet to be fitted in MS frame welded/sealed to the styles and rails with 7mm (5mm+2mm) thick x 15mm wide PVC sheet beading on inner side and joined together with solvent cement adhesive. An additional 5mm thick PVC strip of 20 mm width is to be stock on the interior side of the channel using PVC solvent adhesive etc. complete as per direction of Project Manager/appropriate government authority appointed by GSCDL.

Flush Door

Supplying fitting and fixing in position 35mm thick flush door including lamination of Greenply/Mayur/Century/Kitply or approved equivalent type of approved make with teak wood beading and 1mm thick sun mica mechanically hot pressed to both side including fixing of fixtures like Godrej make Mortice lock having model no 9168, Godrej make Door closure heavy duty type having model no 8340, 125mm aluminum hinges, handle, tower bolt, stopper including cost of all

materials, labour, all taxes, transportation, loading & unloading etc. complete as per specification and direction of Project Manager/appropriate government authority appointed by GSCDL.

Teak wood Shutter

Supplying, fitting and fixing in position 38 mm thick decorative Teak wood shutter 38mm style and 22mm to 25mm thick panel well-seasoned and well-dressed fitted and fixed to sal wood choukaths in all floors at all heights including providing ornamental design as per approved drawing with necessary beadings, cutting grooves in choukaths and for lapping portion of shutter where necessary, including fitting and fixing of Godrej make Mortice lock having model no 9168, Godrej make Door closure heavy duty type having model no 8340, 125mm brass hinges, handle, tower bolt, stopper including cost of all materials, labour, all taxes, transportation, loading & unloading etc. complete as per specification and direction of Project Manager/appropriate government authority appointed by GSCDL

Aluminum Door

Providing & fixing of DOMAL - 40 Aluminum Building Systems, made from 6063 T-6 alloy and tempered euro groove aluminum profile, in approved surface coating, mechanically mitered & jointed with corrosion resistance DOMAL accessories and hardware. Glass infill, of desired thickness, shall be fixed onto using non-aging siliconized microwave treated DOMAL gaskets depending upon on the structural conditions, functions and statistical load requirements.

Sensor Door

Providing and installation of DORMA ES200 easy OPERATOR: Providing Dorma ES200 easy bi parting sliding door (Size- 6'-0"x8'-0") operator with 12mm thick toughened clear glass shutters, anchor fast not, BR soft nose seal, modular design, including internal cover with operator, microprocessor control, self-learning, reversing when obstruction is encountered. Microprocessor-controlled control unit with adjustable parameters for opening and closing speed, hold open time and opening and closing force. Class of protection 20. The system shall have constant power supply 230V, 50/60Hz, UPS supply for various opening sizes all complete as per design. ES 200 is TUV type tested, compliant EU Low voltage directives, production according to ISO 9001 certification type B. The cost including conveyance, loading, unloading, royalties and taxes of all materials, curing-sundries and T&P, etc. required for the work complete as per specification and direction of Project Manager/appropriate government authority appointed by GSCDL.

Fabrication

Curtain

The curtain shall be built up of interlocking lath section formed from cold rolled steel strips. The thickness of the sheets from which the lath section has been rolled shall not be less than 0.9 mm for shutters up to 3.5 M width and not less than 1.2 mm for shutters above 3.5 M width. The lath section shall be rolled so as to have interlocking curls at both edges and deep corrugation at the center with a bridge depth of not less than 12 mm to provide sufficient curtain stiffness for resisting manual pressure and normal wind pressure. Each lath section shall be continuous single piece without any welded joint. When interlocked, the lath sections shall have a distance of 75 mm between rolling centers. Each alternative lath section shall be fitted with malleable cast iron or mild steel strips securely riveted at either end, thus locking the lath section on both ends and preventing lateral movement of the individual lath sections. The clips shall be so designed as to fit the contour of the lath sections.

Lock Plate

A fabricated lock plate of riveted construction made of mild steel sheet of not less than 3.15 mm thickness, reinforced with mild steel angle section of not less than 35 x 35 x 5 mm size at the bottom, shall be interlocked with bottom most lath section of curtain so as to provide contact against the sill, when closed. Alternatively, the lock plate may also be fabricated out of unequal mild steel angles or 'Tee' section, of not less than 5 mm thickness. The lock plate shall be fitted with sliding bolts at either end to engage with suitable receiving pockets at the bottom of guide channels. The sliding bolts shall be capable of being locked by means of padlocks both from outside and inside. The lock plate shall also be provided with pulling handles, one handle for width up to 2.5 m and two handles for widths of above 2.5m. Pulling handles shall be fixed on both the interior side and exterior side of the lock plate.

Guide Channels

The guide channels shall be of mild steel deep channel section and of rolled, pressed or built up (fabricated) construction. The thickness of the sheet used shall not be less than 3.15 mm. The depth of the guide should be such that there is sufficient clearance between the curtain and the inner surface of the guide to avoid any rubbing or obstruction for free movement of the curtain. The curtain shall project into the guide at least 40 mm up to 3.5 m width and 60 mm for greater width and there shall be a clearance of 10 mm minimum between the guide wall and the end clips of the curtain to permit free movement of the curtain.

Size of the Guide Channel

The depth and width of the guide channel shall be as under

Clear width of the shutter	Depth	Width
Up to 3.5 m	65 mm	25 mm
3.5 m up to 8 m	75 mm	32 mm
8 m and above	100 mm	32 mm

Each guide channel shall be provided with a minimum of three fixing cleats or supports for attachment to the walls or column by means of bolts or screws.

The guide channel shall be attached to the jambs, plumb and true, either in the over lapping fashion, projecting fashion depending on the method of fixing.

Bracket Plate

The bracket plate shall be fabricated out of mild steel of 3.15 mm thickness. The size of the bracket plate for different height of different rolling shutters shall be as follows;

Clear height in meters	Size of bracket plate, Min
Up to 3.0 m	315 x 315 x 3.15 mm
Above 3.0 and up to 3.5 m	375 x 375 x 3.15 mm
Above 3.5 and up to 4.5 m	400 x 400 x 6 mm
Above 4.5 and up to 5.5 m	450 x 450 x 6 mm
Above 5.5 and up to 6.5 m	500 x 500 x 10 mm

Above 6.5	To be designed
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The bracket plate shall be hexagonal, square or circular contour. The bracket plate shall have fitted at the centre a U- shaped cast iron or mild steel clamp riveted or welded to it. Since the bracket plate carried full load of the shutter, it should have sufficient cross sectional area to resist the shear force and it shall hold in position rigidly by means of suitable foundation bolts. In the case of push and pull shutter, extra tying of the bracket plate to the guide channel is provided by means of a square bar of not less than 20 mm size. This square bar shall be welded on the back of the guide channel for a length of at least 20 cms. The bracket shall then be attached to the top of this square bar by means of 6 mm counter sunk rivets at a spacing of not more than 100 mm. Angle 40 x 40 x 6 mm split at one end is firmly riveted or welded at the top line of the bracket so that this will act as a foundation hold fast. The angle shall extent at least 20 cms from the edge of the bracket plate. This angle is grouted firmly into the wall with the split end of the angle well buried in concrete. When the bracket is to be fixed on concrete the angle is suitably bent and fixed to the concrete beam or lintel with anchor sleeves and bolts of at least 16 x 75 mm size.

A stopper made out of 40 x 6 mm flat is bolted on to the square bar so that the lock plate may be arrested going beyond the limit.

Roller

The suspension shaft of the roller shall be made of steel pipe of heavy duty and of sufficient diameter so as to resist deflection due to the weight of the rolling shutter. The deflection shall not exceed 5 mm per meter width. The size of pipes for various width of rolling shutters / grills is are given below; The height of the shutter being limited to a maximum of 5 m.

Table 5: Size of pipes for rolling shutters / grills

Width	Size of pipe
Up to 3 m	40 mm nominal bore
Up to 6 m	50 mm nominal bore

The pipes of the suspension shaft which are clamped to the bracket shall be fitted with rotatable cast iron pulleys to which the curtain is attached, the pulleys and the pipe shaft shall be connected by means of pre - tensioned helical springs to counter balance the weight of the curtain and to keep the shutter in equilibrium in any partly opened position.

When the width of the opening is greater than 3.5 m, the pulley shall be inter connected with a cage formed out of mild steel flats of at least 32 x 6 mm and mild steel dummy rings made of similar flats so that the torque is distributed uniformly. In such cases, self-aligning two row ball bearings shall be provided with special cast iron castings at the extreme pulleys at either ends. The caging rings shall have a minimum spacing of 15 cm and there shall be at least 4 number flats running throughout the length of the roller.

In the case of shutters for larger openings where the operation of the shutter is carried out using mechanical gear the roller shall be fitted with a pinion wheel at one end which is in contact with a worm fitted to the bracket plate. In this case also the pulleys shall be interconnected with caging with two ball bearings.

Hood Covers

Hood covers shall be made of mild steel sheets not less than 0.900 mm thick. They shall be of hexagonal, square or circular contour depending on the contour of the bracket plate.

The hood cover shall be stiffened with angle or flat stiffeners at top and bottom edges to retain shape. The hood cover shall be fixed to the bracket plate by means of angle, cleats and supported at the top at suitable intervals for preventing sagging.

Gears, Worms, etc.

All gears, worms, etc., used in the assembly of the rolling shutters shall be machine-cut. Worm gear wheels shall be of high grade cast iron or mild steel or phosphor bronze. The worms shall be of mild steel or gun-metal or phosphor bronze.

Fixing Bolts

All fixing bolts shall be of good quality and adequate strength and at sufficiently close pitch to ensure strength and rigidity of the rolling shutter after erection.

Operation

Self-Coiling Type Rolling Shutters

Self-coiling type rolling shutters shall be raised or lowered manually by means of a pulling hook applied to the pulling handles fixed on the bottom lock plate. The length of the pulling hook shall be adequate to push the bottom lock plate to the topmost position with ease.

Gear Operated Type Rolling Shutters

Gear operated type rolling shutters ordinarily employ a worm drive arrangement, the worm driving the worm wheel attached to one end of the roller. Worm drive is preferred in view of its irreversible nature, which provides a safeguard against any accidental downward descent of the curtain due to failure of the springs.

Gear operated type rolling shutters shall be operated by means of bevel gear box and crank handle. The bevel gear box shall be mounted on the wall adjacent to the shutter at a height of approximately 0.85 m from the floor. The gear box shall operate the worm by a straight shaft connecting the top of the gear box and the worm. The crank handle of the gear box shall be detachable. If so desired by the customer, the crank handle operation shall be provided on both sides of the wall by extending the horizontal shaft of the gear box backwards and providing on extra crank handle at the back of the wall. The gear reduction shall be calculated to reduce the pressure exerted, on the crank handle.

Rolling Grills

- cclxviii. Rolling grills are similar in design, construction and operation to rolling shutters and consequently all the provisions applicable to rolling shutter apply equally to rolling grills, except in respect of the curtains. Rolling grill curtains may be built of aluminum alloy or cold rolled steel sheet links of 0.90 mm thickness assembled on tubes or rods. Grills may also be manufactured out of 8 mm diameter mild steel or aluminum alloy round bars.
- cclxix. Rolling grill links may be manufactured in a number of designs to suit manufacturer's convenience and customer's preference as also the purpose, the degree of safety required, etc. The details of fabrication and assembly of the rolling grill curtain depend on

the actual type of links chosen. The function of a rolling grill is to provide visibility and/or ventilation, where necessary. At the same time, it provides less protection and less safety as compared to a rolling shutter. This factor shall be borne in mind when specifying rolling grills.

- cclxx. Rolling Shutter-cum-Grill: In situations where a certain amount of ventilation combined with safety is called for, for example, in transformer rooms, sub-stations, etc., the rolling shutter may have a small rolling grill portion either at the top or at the bottom or at both places. The height of the grill portion shall be a maximum of 0.5 m.

Painting

All component parts of the rolling shutter (excepting springs and the inside of guide channels) shall be given one coat of a brushing quality ready mixed primer conforming to I.S. 102-1962 before dispatch. Where a rust inhibiting quality of paint is called for, a zinc chromate primer shall be used. The portions of a rolling shutter where there is contact between aluminum and steel shall be painted with a zinc chromate primer to avoid possibility of corrosion due to electrolytic action.

PAINTING WORKS

Indian Standards

The following I.S. apply to this section;

I.S. NO.	SUBJECT
5410-1969	Specification for cement paint, colour as required.
2932-1974	Enamel, synthetic, exterior, under coating and finishing (First Revision)

cclxxi. Paints and allied material: Painting to all surfaces shall be with conformity to I.S.2395 (Part – I & Part – II). Steel painting shall be with conformity to I.S.1477 (Part – I & Part – II) I.S.1661. Only first quality paints duly BIS marked shall be used for the finishing item wherever required. Material shall be as per the following IS specification: wooden & metallic surface:

- pp) Synthetic enamel finish (for exterior uses) as per IS: 520
- qq) Synthetic enamel with semi glass finish (for interior uses) as per IS: 133
- rr) Priming coat IS: 102
- ss) Zinc chromate primer on Iron Steel IS: 107/ IS 2074
- tt) Aluminum paint IS: 165/IS 2339
- uu) Turpentine oil IS: 83/ IS 533
- vv) Linseed oil IS: 77,75 & 78
- ww) Varnish Exterior IS: 338
- xx) Varnish Interior IS: 337
- yy) Filler for enamel paints IS: 110
- zz) Wood filler IS: 345
- aaa) Putty for wooden frame IS: 419
- bbb) Putty for metal frame IS: 420 □ Brushes IS: 384
- ccc) Paint remover IS: 430
- ddd) Shellac IS: 16

Painting, White washing and Distempering: These items shall be executed as per Sikkim PWD building Specifications. Painting and varnishing works shall be executed as per Sikkim PWD building Specifications. Painting on Plastered/ Concrete Surface: The plastered surface above dado as per relevant Specification of Sikkim PWD building Specifications. Only first quality paint/ emulsion shall be used. The item shall be executed as per Sikkim PWD building Specifications of painting. Painting Wooden Surfaces shall be painted with first quality approved brand of paint and execution of item shall be carried out as per Sikkim PWD building Specifications. Painting Iron and Steel Work: Iron and Steel Works shall be painted as per Sikkim PWD building Specifications. The first coat shall be applied of red oxide primer of first quality. The subsequent coats shall be of approved shade and approved brands of first quality paints. White Washing shall be executed as Sikkim PWD building Specifications and Colour washing shall be executed as per Sikkim PWD building Specifications. Oil Bound distempering

for internal finishing shall be executed as per Sikkim PWD building Specifications. Cement based paints: Cement based paints of approved make and shade shall be executed as per relevant specifications. White and color washing shall be with conformity to I.S.6278

Cement Paint

Cement paint shall comply with I.S. 5410-1969, specification for cement paint, colour as required. The material shall be in powder form, free from lumps that are not friable and when mixed with required volume of water shall be suitable for use on porous surface of masonry, concrete and rough plaster work.

Preparation of Surface

- cclxxii. The surface shall be thoroughly cleaned of all dirt, mortar drops, efflorescence, chalking, grease and foreign matter.
- cclxxiii. Before applying cement paint the surface shall be thoroughly wetted to control surface suction. The surface shall be moist but not dripping wet when paint is applied. Surfaces which readily absorb moisture, shall be wetted in one operation not more than one hour before painting. Surface which absorb moisture slowly shall be wetted in at least two operations not less than 30 minutes.

Preparation Of Cement Paint

Cement paint shall be made by adding equal volume of paint powder to water and the mix stirred to obtain a thick paste. Which shall then be diluted to a brush able consistency in the proportion recommended by manufacturer differs, the recommendation of manufacturer shall be invariably followed. The water mixed paint shall be kept well stirred during use and shall be applied within one hour of preparation. To prevent algae and moss growth and efflorescence, silicon base water repellent compound may be added to mixture at the rate as recommended by the manufacturer. The lids of cement paint drums shall be kept tightly closed and not in use as the cement paint rapidly become air set.

Application of Paint

- eee) To maintain uniform mixture and to prevent segregation, the paint shall be stirred frequently in the bucket.
- fff) Unless otherwise indicated new surface shall be treated with a minimum of two coats of cement paint of the same colour. Not less than 24 hours shall be allowed between two coats and the second, or subsequent coat shall not be started until the preceding coat has become sufficiently hard to resist marking by the brush being used. In hot dry weather the preceding coat slightly moisten before applying the subsequent coat. The paint shall be brushed in uniform thickness and free from excessive brush marks. The laps shall be well brushed out.
- ggg) The colour shall be even shade over the whole surface. If it is patchy or otherwise badly applied the work shall redone by the contractor at his own cost.

Curing

Painted surface shall be sprinkled with water using a fog spray two or three times a day. Curing shall be done between coats and for at least two days following the final coat. The curing shall be started as soon as the paint has hardened so as not to damage of the spray, about twelve hours after the application.

Painting Wood Work

Preparation Of New Surface

All wood work shall be dried free from dust, dirt or any extraneous materials. Flat portion shall be smoothed with abrasive paper used across the grain prior to painting. All loose knots removed, and holes filled.

Priming

On clean prepared surface a priming coat of paint shall be applied by brushing. Unless otherwise directed, the priming coat shall be applied before the wood work fixed in position.

Filler Coat

Filler coat where indicated, shall be applied with a putty knife and subsequently rubbed down to a level surface, with the abrasive paper. The filler coat shall be of an optimum thickness and shall be allowed to fully harden and flatten before subsequent coat is applied. As many layers or filler is necessary shall be applied allowing each coat to harden and flatten before next coat is applied.

Under Coat

Under coat shall be applied by brush after the surface has been primed, stopped, filled and rubbed down to a smooth surface. After drying, the under coat shall be carefully rubbed down and wiped clean before the finishing coat is applied.

Finishing Coat

The finishing coat shall be applied by brush, the finished surface shall be free from hair or brush marks, streaks, clogging of paint, puddles in the corner etc.

Painting Steel and Iron Work

Preparation of New Surfaces

The surface shall be thoroughly cleaned of dirt, fluxing material, other foreign material and scrapped thoroughly with hand scrapper followed by wire brushing first with course and then with fine wire brushed and finally sand papering the surface to remove all mill scale and dust. The surface shall then be wiped finally with mineral turpentine to remove oil and grease etc.

Temporary rust protective materials applied to steel sheets to protect during transport and storage shall be removed with suitable solvent as a preliminary to other preparatory treatment.

Surfaces already pre-treated or primed in a factory shall be carefully inspected and damage areas shall be thoroughly degreased and cleaned of all dust and touch up.

Primer Coat

Immediately after the preparation of the surface priming coat shall be applied by brush, working in the paint into the fine dents and ensuring a continuous film without runs and holds.

Filler Coat

After the primer coat is harden and dry, the surface shall be rough sanded without scratching or in any way damaging primer coat and surface cleaned free from dust. Deep dents and scratches, if any shall be filled with paste filler using a good putty knife pressing firmly into the dents applying in optimum layers. Each layers shall be allowed to dry hard and then cut down by wet rubbing to a smooth finish.

Where indicated, after the paste filler is hard dry, a coat of liquid filler shall be applied by brush to fill all fine dents allowed to hard dry and then wet rubbed to a smooth finish.

Under Coat

Under coating shall be applied by brush. The film shall be allowed to hard dry, wet rubbed and cut down to a smooth finish ensuring that at no place under coat is completely removed.

Finishing Coat

Finishing coat shall be applied for brush. Special care shall be taken while painting over bolts, nuts, rivets and overlaps etc.

Mode of Measurement

Payment shall be made on Sq. mt. basis by applying the following coefficients for various types of works.

WOOD WORK:DOORS, WINDOWS,ETC.

Sl.No.	Description	
01	Paneled or framed and braced	1.5 (for each side)
02	Ledged and battened or ledged battened	1.5 (for each side)
03	Flush	1.25 (for each side)
04	Part paneled, and part glazed or gauged.	1.0 (for each side)
05	Fully glazed or gauged	0.5 (for each side)
06	Fully venetianed or louvered	1.5 (for each side)
07	Trellis or Jafriwork	2 (for painting all over)

STEEL WORK: DOOR, WINDOW, ETC.

Sl.No.	Description	
01	Plain sheeted steel doors	1.5 (for each side)
02	Fully glazed or gauged	0.5 (for each side)
03	Part paneled, and part glazed or gauged.	1 (for each side)
04	Corrugated sheeted	1.5 (for each side)
05	Rolling shutters	1.5 (for each side)
06	Collapsible gates	1.5 (for painting all over)

GENERAL WORK

Sl. No.	Description	
01	Expanded metal, grill work and gratings balustrade, railings	1 (for painting all over)
02	Fencings and gates including standards, braces rail, stays	1 (for painting all over)
03	Corrugated iron sheeting in roots, side claddings etc.,	1.14 (for each side)
04	A.C. Corrugated sheeting.	1.20 (for each side)
05	A.C. Semi corrugated sheeting	1.10 (for each side)
06	Nainital pattern roofing with plain sheets.	1.10 (for each side)
07	Nainital pattern roofing with corrugated sheets	1.25 (for each side)
08	Wire gauge shutters including painting of wire gauge.	1 (for each side)

STRUCTURAL GLAZING

Scope of Work

Scope includes design and execution of the work of providing semi unitized structural glazing with all the accessories such as extruded aluminum frames, aluminum composite panels, glass wool insulation, anchor clips, fasteners, brackets, gaskets, sealants, spacers, baker rods and related works perimeter flashing, continuous gutter system at each floor of the glazing, performance test etc., complete.

Codes to be followed: -

IS 875 (Part 3) : Code of practice for Design loads for buildings and structures
Wind loads.

AS 1288-1984 : Glass in Building

ASTMC 1036-85BS 6262 : Glazing

AS 2208 : Safety glazing material

ASTMC 1048-87/EN12150 : Heat strengthened and fully tempered glass

AS 1664 : SAA Aluminum alloy sections.

For all other works, applicable IS codes shall be followed.

Basics for Structural glazing

Designing the Curtain wall / Semi unitized structural glazing system as per design intent and as per approved drawings, preparation of shop drawings, supply, fabricate the panel with the specified glass on the child frame at factory, erect the system on erected extruded main frame & Transom fixed on supporting system at site as per approved shop drawings at all floor levels and for all heights. Designing, providing and fixing frame supporting system, the framing system (i.e. Main & Child frame) to support Spandrel panels either with Monolithic Glass or Laminated sandwiched composite panel (ACP),/openable Top hung window panels/ punched strip windows/ decorative capping to any shape & profile, smoke seal, flashing including gaskets, sealants necessary accessories, as part of the system on a continuous framing supported between floors as detailed below and as per the specification for external facade system.

Design the split framing semi unitized glazing system in case of Punched windows with vision panel proposed with either Monolithic Glass as specified maintaining groove width shall not be more than 12 mm both in horizontal and vertical. Conducting the test for the materials involved in the system, field test on the erected system at site as per the test criteria set out in the specification of External Facade system. Submission of methodology for the Materials and assembly (Mock-up& field test) supported by the copy of relevant codes & Standards and the

same shall be got approved by the Project Manager/appropriate government authority appointed by GSCDL prior to testing. Protection of the System and Materials till handing over to the Project Manager/appropriate government authority appointed by GSCDL, removal of the unwanted materials, broken glass, Screws, bolts, Nuts, Packing Materials, debris etc. Regularly and keeping the premises neat and clean at all times.

Coordinate the details of the façade cleaning system during the preparation of shop drawing and incorporate such details in the shop drawing submitted for approval of Project Manager/appropriate government authority appointed by GSCDL. Maintaining the system by means of periodical inspection at site (bi-monthly) and checking the system and Materials involved in the system during Defects liability period (this will not relieve the contractor from the condition laid down in the contract under defects liability period) to ensure that the system and all materials are free from any defects during this period. Providing the Guarantee for the entire External Façade system to the specified period in an approved format supported with Back to back guarantee from the specialized Material supplier like Glass, Aluminum composite panel, Gasket, Sealant, Hardware etc. complete as directed by Project Manager/appropriate government authority appointed by GSCDL.

cclxxiv. Design:

hhh) Design: Design pre-assembled aluminum Semi unitized Structurally glazed Panel with continuous framed panels / Strip window / Punched window system with split mullion to any shape and profiles shall be designed to with stand the design wind pressure as per relevant IS code (Test pressure shall be 1.5 times of the design wind pressure) and fixed at horizontally / vertically / sloped / curved position etc. as shown in the approved drawings by using Aluminum extrusions, Glass, Spacer tape, Gasket, Sealant etc. as specified.

Contractor shall be responsible to determine the maximum design wind pressure and lateral forces,

moments, stresses etc. applicable for the system. Negative/suction pressures if determined as per IS 875 and Lateral forces as per code IS 1893 shall make allowances as described in the code for corner effects on the system. System shall be designed with Air

pressure equalization chamber and concealed continuous gutter vertically and horizontally at all levels as self-

drainage barrier to achieve watertightness besides providing EPDM Gaskets on the frame and EPDM Gasket/Sealant on the external groove as air and water barrier.

iii) System: System shall be designed to satisfy the structural design criteria specified in the technical specification with self-bearing modular elements supported between floors (Supporting span of minimum 3.50 meter) in the case of structural glazing and split mullion supported between sill & lintel/beam in the case of punched windows, EPDM Gaskets on the frame and Gasket/sealant on the groove to prevent the system from Air & water penetration, double adhesive spacer tape, backer rod, sealant, supporting

brackets (Resistance to design wind pressure), Separator Gaskets for Bi-Metallic Corrosion, Pressure equalization chamber in the system, built-in continuous internal drainage gutter for collection and facility at lowest floor level to drain out penetrated water, in built adjustability to accommodate thermal expansion, thermal movement and movement due to any other forces etc.

System shall be designed with Gasket/Sealant on the external groove with colour anodized aluminum holder all-round the panel to the required width and thickness as per design as Dead load support to the Glass panel. Non Staining sealant between glass & aluminum holder around the panel shall be provided. Glazing the panel with child frame shall be done only at factory at the controlled atmosphere to erect the panel on erected extruded aluminum main member and transom with supporting system at site fixed on the RC surface. The Mullion and sill / head Transom flush on inside of the facade. Intermediate transoms shall be provided keeping 2 to 3mm recessed from the inner face of the mullion. Joints between mullion and transom shall be filled with weather sealant on the inside. All transoms shall have uniform in depth on the inner face of the system. Vertical in-situ glazing shall not be carried out during construction/erection stage. System shall be designed in such a way that the outer surface of insulated glass unit, monolithic glass unit and Aluminum Composite Panel shall be in the same plane or as per approved drawing. Aluminum shim shall be used for level adjustment of bracket but more than 20 mm is not acceptable. If more than 20 mm bracket shall be designed according to site condition.

- jjj) Movement: System shall be designed to accommodate movement due to any force including lateral/dynamic pressure movement, horizontal & vertical building movement panels and on the framing system with support brackets, gaskets and fastening devices. System shall be designed to accommodate the size and shape of the glass panel as per the approved drawings including approved modifications as may be required during execution as well as all other incidental forces and stresses likely to be experienced under service conditions, i.e. Lateral force, Dead weight and Thermal expansion due to building movement both vertical and horizontal etc.

The supporting system shall consist of Brackets / Clamps, fastening straps, nuts, bolts, rivets, washers and other fastening materials etc. Extruded sections shall be designed to accommodate Monolithic (Single) Glass and Aluminum composite panel as per the approved shop drawings. Extruded aluminum sections shall be 63400 (H9) grade conforming to IS 8147, finished with AC25 grade Architectural quality electrolytic colour anodic coating of approved colour conforming to IS 1868.

- kkk) Glass: Fixing the Monolithic (single) Glass as per specification for both vision and spandrel panel conforming to the minimum spectral parameters as specified.

III) Gaskets: Providing and fixing weather barrier to ensure the air & water tightness at minimum 3 stages and to ensure that the system is thermally broken systems. The first barrier exposed to weather condition shall be Elastomer silicon synthetic rubber manufacture by oven process at different stages conforming to BS or approved equivalent IS. The properties of Elastomer silicon synthetic rubber such as hardness, tensile strength elongation compression test & ozone resistance shall be in accordance with BS 903 & BS 903A minimum hardness (shore A) of Elastomer silicon synthetic rubber shall be 65 to 75 Degrees and the weather strip within the system for unexposed shall be Elastomer EPDM (Ethylene Propylene Diene Monomer) synthetic rubber and its properties like hardness, expanded density (Specific gravity) compressive set, water absorption, skin surface, cell structure, ozone resistance, low temperature includes work shall be in accordance with ASTM D – 1056 and minimum hardness (Shore A) shall be 61/71 Grade.

In general, EPDM gaskets / silicon synthetic rubber shall be as per pre-approved make. Contractor shall submit the Manufacturer test certificate conforming that the properties of the Gasket supplied is meeting the specification, codes & standards and copy of such codes shall be produced by the Contractor for verification of Project manager/ appropriate government authority appointed by GSCDL. Contractor shall arrange to carry out the test to check the properties of EPDM / silicon rubber gasket on the random sample selected by Project manager/ appropriate government authority appointed by GSCDL. (Min. 3 Nos of each type to a required length) and the contractor shall make sure that the properties are meeting the codes and standards and specifications.

mmm) Sealing: Design bite and thickness of structural sealant to withstand 3 times of the stress caused by the design wind pressure specified above and to ensure the same, the design calculation of sealant manufacturer shall be submitted along with shop drawing. Necessary materials as proposed in the shop drawing such as Extruded member with finish, glass and any other material required by the Sealant manufacturer shall be supplied to them to carry out the test as per relevant codes standards in order to validate the bite and thickness designed by them. Contractor shall obtain the test certificate from Sealant manufacturer and submit the same along with shop drawing and supported by the copy of relevant codes and standards. Contractor shall ensure that the bite and thickness of sealant as designed & determined by calculation, verified and tested by Manufacture's is followed in the shop drawing and the same shall be adopted for the glazing at factory after the approval of shop drawing. Field test shall be conducted for adhesion of sealant with in the quoted rate.

Supplying and fixing the Sealant as per specification and Double Adhesive spacer tapes for glazing the panel at factory. Spacer tape shall be open cell polyethylene of reputed brand approved or approved equivalent, Jointing / Sealing of the glazed panel at factory shall be done with Non-

structural (weather) sealant / Non staining sealant of DC 991 HP of reputed brand or approved equivalent with Polyurethane baker rods of reputed brand or approved equivalent. Acetoxy sealant shall not be used for Structural Glazing application. In general, providing and fixing the Structural and non-Structural (weather) sealant shall be as follows:

nnn) Shop / Factory Sealants:

- Structural sealant shall be of reputed brand or approved equivalent.
- Non-Structural (weather) sealant shall be of reputed brand or approved equivalent.

ooo) Field Sealants:

- Structural sealant shall be of reputed brand or approved equivalent.
- Non-Structural (weather) sealant shall be of reputed brand or approved equivalent.

ppp) System Supports: Providing and fixing the supporting system with Brackets / Clamps including fastening straps, nuts, bolts, rivets, washers etc. as per design requirement and as per approved shop drawing. Brackets / Clamps shall be of hot dip galvanized steel and fastening materials shall be Non - magnetic Stainless steel 300 series - 316 grade of reputed brand or approved equivalent. Galvanizing thickness shall be in accordance with IS 2629 and 4759. Providing and fixing serrated plates or serrated washer wherever required as per the system requirement and as shown in the approved shop drawing. Shim thickness beyond 20mm is not permitted. Shims shall be similar material, preferably with aluminum, not more than 20mm thick and if the variation is beyond 20 mm, the bracket shall be designed accordingly with fastener.

qqq) Smoke seal: Providing and fixing Smoke seal / Fire stop using extruded aluminum channel with cap for continuous structurally glazed framing system with required thickness as per site and in general the thickness of channel and cap shall be 2 mm and to a width as required between transom and sill finish material and it shall be 63400 (H9) grade conforming to IS 8147, finished with AC25 grade Architectural quality electrolytic colour anodic coating conforming to IS 1868 of approved colour. Aluminum colour anodized extruded Channel shall be supported with the help of Aluminum bracket as designed and this bracket to be fixed on the wall / RCC surface with necessary SS anchor bolt and fastener of reputed brand or approved equivalent. This channel with cap shall be provided between Sill finish Material (Civil scope)) and Curtain wall / structural glazing member at sill level and between RCC member face and structural glazing member at soffit level / false ceiling and etc. complete. All the Joints between the capping channel and any other finish material at both sill and soffit level shall be sealed with intumescent sealant of reputed brand or approved equivalent.

The channel with cap shall be provided between Sill finish Material (Sill finish material shall be paid separately) and Curtain wall / structural glazing member at sill level and between RCC member face and structural glazing member at soffit level / false ceiling and etc. complete. All the Joints between the capped channel and any other finish material at both sill and soffit level shall be sealed with Intumescent sealant of reputed brand or approved equivalent. Also, close the gap on the vertical surface between the face of column/wall/partition and structural glazed frame/glass by using extruded aluminum channel with cap with anodized finish aluminum bracket supported on the column/wall/partition and in general the thickness of channel and cap shall be 2 mm and to a width as per drawing and it shall be 63400 (H9) grade conforming to IS 8147, finished with AC25 grade Architectural quality electrolytic colour anodic coating conforming to IS 1868 of approved matching colour to the Mullion & transom.

rrr) Flashing: In addition to the Channel specified above, providing and fixing flashing at all floor levels as part of the system (applicable only for continuous Curtain wall / structural glazing portion) made to profile as shown in the approved drawings and the profile shall be made out of hot dip galvanized sheet 1.2 mm thick and galvanizing coating thickness shall be in accordance with IS 2629 & 4759. In general, the flashing shall be provided to the entire length of Curtain wall / structural glazing portion horizontally at all floor levels and at terrace level with an overlap of 100 to 125 mm in plan and the joints shall be sealed with weather silicon sealant and with recessing anchoring system soaked and SS fastening devices in sealant of reputed brand or approved equivalent. Also, the flashing shall be provided at parapet top below the coping to drain the water during any seepage through the sealant joints with overlap of 100 to 125 mm in plan with sealant at joints to make sure that no water leakage through coping / flashing joints.

sss) Top hung Openable Window Hardware: Providing and fixing the hardwares for the shutter with heavy duty self-balancing stainless steel friction hinges, corner transmission, detachable restrictor stay assembly and Multi point locking with heavy duty mechanism (minimum 6 points including corner locking point), handle with key at centre of the transom having a ceremony. Handle / cremone shall be made out of aluminum die cast with powder coat finish - 65 microns, matching to the transom profile colour. Rate shall include the shutter frame as designed to accommodate the Hinge, stay arm and multi point lock, EPDM gaskets, fastening materials including all other necessary materials etc. Hinge shall have thermoplastic asymmetric end cap to ensure weather tight sealing at the ends.

Rate shall exclude cost of Glass and main frame, but include cost of sub frame for shutter and the frame to be designed to fix all the hardwares specified like heavy duty self-balancing stainless steel friction hinges of

reputed brand or pre-approved equivalent make and Multi point lock (minimum 9 point) and handle / cremone size of 110 x 27mm with key of reputed brand or pre-approved equivalent make. Shutter will have a provision for hold open option and to restrict the opening not more than 200 mm and to keep the vent weather tight while closing the shutter. Gaskets shall be designed to ensure the air and water tight including noise control while the shutter is closed in position and the gasket shall be silicon synthetic rubber of required strength. Rate shall include for providing master key - 3 sets (floor wise) & Grand master key - 3 sets (building wise) for openable with necessary coding engraved on the keys etc., complete.

ttt) Visual mock up: Providing and fixing full scale visual mock-up with minimum 3 bays with openable window, ACP cladding, smoke seal and other special architectural features etc., to establish the actual system design prior to proceeding with full scale production of the materials involved in the system. Conduct a water test on the installed visual mock up system, (only water using hose real to the specified pressure in the technical specification) and submit the test result of the system for review. Rate shall include for any improvements required on the system based on the test result by the Glazing contractor.

uuu) Field Test: Conduct Field test at site on the installed glazing system as per the criteria set out in the specification of the external facade system and as per the Methodology described in ASTM 501-2. Test shall be carried out in the presence of Project Manager/appropriate government authority appointed by GSCDL. Methodology for carrying out the test shall be submitted to Architect/ Project manager/ appropriate government authority appointed by GSCDL for approval prior to testing. The results shall be recorded and the reports shall be submitted to the Project manager/ appropriate government authority appointed by GSCDL for approval. If Field test fails, contractor shall submit the rectification methodology to correct the defects as per the performance data set out in the Specification of external facade system and as per the methodology described in the relevant code for the approval of Project Manager/appropriate government authority appointed by GSCDL. Defects, if any noticed shall be rectified to the satisfaction of Project Manager/appropriate government authority appointed by GSCDL.

vvv) General : System design in total, including Aluminum extruded frames, type & thickness of Glass pane, Aluminum sleeves at connections, inserts, EPDM Gaskets / Silicon rubber, Adhesive tapes, Sealant, Supporting system / bracket including fastening and anchoring system & Materials specified in the schedule and the system details as shown in the tender drawing are only tentative and is meant to set out a general outline of the Proprietary system and minimum requirements/ properties of the system and component parts.

The general guidelines governing the system design and performance parameters as set out in the Specification relating to External Façade System and the contents therein. Since the External Façade system in terms of Design, materials, all fixing details, methodology of execution are proprietary in nature, the onus of the design and Performance requirements, shop drawing, execution etc. satisfying the design intent and specification of external facade system including conducting the site survey prior to and after preparation of shop drawing and accommodating the site conditions in the system at appropriate levels etc. lies solely with the Contractor.

www) Mode of Measurement: Length and breadth of the superficial area of the finished work shall be measured centre to centre of the grooves on the external surface viewed externally correct to a centimeter under the respective items. Areas shall be calculated in a square meter correct to two places of decimal.

xxx) Rate. Quoted rate shall include the cost of all materials and labour involved in all the operations as specified above, specified in the external facade system, to execute the work as per approved drawings / shop drawings including, scaffolding, infrastructure facility, tools and plants etc. necessary for execution of the respective item for all height and for all floor levels, Item measurable in sqm. Rate shall exclude cost of Insulation on spandrel, but includes the field test, visual mock up, supplying and fixing of glass & fixing of window hardware. Supply of hardware for top hung window. Supplying and fixing of Insulation with tray on spandrel shall be measured separately and paid under respective item given in the tender. Designing, providing and fixing of Aluminum Grille / Louvers of Faneline make shall be fixed on the system by using aluminum box section 50mm X100mm with minimum 2.20mm thick as a main frame. Grille / Louver panel shall be fixed on the aluminum main framing system with suitable size and thick brackets shall be fixed on the RC / MS surface with vertically to the spacing not more than 1500mm and horizontally not more than 1500mm by using SS 316 grade anchors and bolts and the complete system shall be designed to with stand the design wind pressure as per IS code or relevant international code (Test pressure shall be 1.5 times of the design wind pressure)

In addition to the aluminum main frame, aluminum clip on vertical support of 2.0mm thick & covering profile of 0.7mm thick to fix the aluminum Grille shall be fixed at every vertical aluminum main frame as per manufacturer specification with specified product code in the bills of quantities with not less than 0.80 mm thick shall be fixed as per drawing with pitch as specified in the BOQ using SS 316 grade bolt and nut arrangement. The aluminum grille and all aluminum frames shall be finished with PVDF coating with approved colour. All aluminum sections shall be 6063-T6 Conforming to BS 1474 / 63400 (H9) grade conforming to IS 8147. Rate shall include the supplying and fixing of aluminum main frame, sub frames

to receive the grille, aluminum brackets / clamps with necessary SS 316 grade anchor fastener, nuts, bolts, rivets, aluminum end caps on the terminations and washers of approved make and all materials involved in the work.

yyy) Mode of Measurement: Length and breadth of the superficial area of the finished Louver area shall be measured on the external surface viewed externally correct to a centimeter under the respective items. Areas shall be calculated in a square meter correct to two places of decimal.

zzz) Exterior glazing work with high pressure laminate glass for exterior cladding, fitted with spider fittings of reputed brands make 316 grade, Chrome polished with 12 mm tuff front glass and 19 mm thickness fin Plate glass fixing with router support, fastener and silicon, tape etc. complete.

aaaa) Providing & Fixing Semi unitized type Structural Glazing System in fixed panels with frame work including mullions, double glazed hermetically sealed insulating glass with 12 mm thick Heat reflective transoms & sub frame (No aluminum section to be exposed to outside and only glass panels with silicon joint to be visible from outside) made of specially designed extruded aluminum section of Jindal / Hindalco/ OEL(Alom) or approved equivalent make conforming to 6063 T5 or T6 as per B.S.1474, duly anodized/ powder coated in approved color & shade with mullions fixed to RCC beams/columns through adequately designed MS back up materials and Anchor fasteners of Hilti / Fischer or approved equivalent make, having toughened glass on outer face plus 12mm air gap with perforated aluminum spacer bar and 6 mm clear float toughened glass on inner face (DGU) of Saint Gobain / AIS or approved equivalent make including providing EPDM gasket, silicon sealants etc. Glass to be fixed with structural silicone of Dow Corning/GE /JL/Alstone or approved equivalent make & Norton tape or approved equivalent, with weather sealant in silicone of Dow Corning/GE /JL/Alstone or approved equivalent make & Norton tape or approved equivalent, with weather sealant in between the joint to make leak proof glazing, etc. complete as per the approved drawing and direction of Project Manager/appropriate government authority appointed by GSCDL.

bbbb) Providing, fitting and fixing Compact grade glass 12mm thickness for Cubicle of reputed brands, including transportation, fixing and taxes all complete as directed by Project Manager/appropriate government authority appointed by GSCDL.

cccc) Glass Partition:

Supplying and fixing of manually operated 12mm thick toughened glass partition cum door including lock, handles & screws etc. other such fittings required including all labour charges for fixing and all applicable taxes etc., complete and as per approved drawing and as directed by Project Manager/appropriate government authority appointed by GSCDL

Materials Specifications

Glass

Glass Saint Gobain/ Pilkington/ Galverbel 6mm thick heat strengthened, hard coated (Bronze of tint) Reflective glass possessing the following parameters.

TECHNICAL DATA OF GLASS:

SL.NO.	DESCRIPTION	DATA
1	Light information Transmission Reflection Ext. Reflection Int.	27 % 17 % 23 %
2	UV	6%
3	Energy characteristics ER EA SF	10% 76% 0.24%
4	Shading co-efficient	0.28
5	U – Value	2.76
6	Relative heat gain	216 watts/ M2

Aluminum Composite Panels

Shall be from Alucobond or Renobond and thickness shall be 4mm. The colour to match with the colour existing Environments.

- cclxxv. Structure Silicone
- cclxxvi. Dow corning
- cclxxvii. DC 995 1 Part & DC 983 2 Parts
- cclxxviii. Aluminum Sections
- cclxxix. Indal Co./ Jindal / Boruka
- cclxxx. Conforming to IS 63400 t5 /16063. Alloy AlMg SI-05
- cclxxxi. Minimum thickness = 2mm
- cclxxxii. Anodization: Anodized to approved colour to minimum thickness of 20-25 microns.
- cclxxxiii. PVDF 2 Coating - To approved colour to a minimum thickness of 80-100 Microns.

Thermal Insulation

50mm thick chemically inert semi rigid black faced fiber glass batts with a density of 60 kg/m³. Insulation batts shall be mechanically restrained along all edges to maintain a regular air space of not less than 40mm between the inboard surface of spandrel /glass and black facing of the insulation,

General

- cclxxxiv. Mode of measurement: Actual quantity executed shall be measured against each item of work and paid for accordingly.
- cclxxxv. For structural glazing: Out of visible surface area shall be measured in Sq. mt.
- cclxxxvi. For roof capping: Actual area of sheet covering shall be measured in Sq. mt.
- cclxxxvii. Insurance: Contractor should obtain all risk policy at his own cost.
- cclxxxviii. Performance guarantee: as specified below.

Sl.No.	Item	Guarantee period	Life expectancy periodYears/Cycles
1	Glass units	10 Years	30 to 40 Years
2	Insulating glass units within cavity electric operation blinds	N/A	N/A
3	Gaskets ((Type: Extruded silicon TypeEPDM)	20 Years	30 to 40 Years
4	Anodized surface finishing	10 years	N/A
5	Galvanized surface finish (Type: Hot dipped zinc)	20 Years	30 to 40 Years
6	Sealant(Type: Dow corning silicone)	20 Years	30 to 40 Years
7	Insulation (Type: Mineral wool)	20 Years	50Years
8	Membranes & Vapor barriers (Type: Various)	---	30 to 40 Years
9	Bracketry & sub construction	10 Years	30 to 40 Years

Quality Assurance

Requirements Of Regulatory Agencies

You must comply with applicable City, Indian and Owners Building codes and Regulations.

Qualifications of Manufacturers

Products used in the work shall be produced by manufacturer regularly engaged in manufacturing of similar items and with a history of successful production acceptable to the Project Manager/appropriate government authority appointed by GSCDL.

Curtain Wall Contractor's Qualifications

- cclxxxix. Work of this Section shall be performed by one contractor, who is regularly engaged in the engineering, fabrication, finishing and installation of curtain walls including glazing and sealing of glass, comparable to work on this project. The contractor shall demonstrate to the satisfaction of Architects/ Project manager/ appropriate government authority appointed by GSCDL and Client that he has successfully performed comparable projects over the previous five years.
- ccxc. Subcontracting any part of the work is specifically prohibited, except for that which may be approved by the Project Manager/appropriate government authority appointed by GSCDL in writing prior to award or the Contract. If approval is granted to subcontract installation and/ or glazing, approval is contingent upon the supervision of his subcontractor(s) by the same full time supervisor who coordinates and supervises mock-up work and installation at the project.

Quality Control

Shop and field materials and workmanship shall be subject to inspection of the Project Manager/appropriate government authority appointed by GSCDL and their representatives at all times. Such inspection do not relieve that Contractor from obligations to provide materials conforming to all requirements of the Contract Documents and industry standards for material

quality.

DESIGN AND EXECUTION RESPONSIBILITY

- ccxci. The Contract Documents define only the design intent and general performance requirements. The contractor is totally responsible for design, structural calculations, shop drawings, fabrications, installation, warranties, certifications and related documentation, checking from Architect's side will be only for general conformance to aesthetics.
- ccxcii. The wall system manufacturer shall be entirely responsible for the design, fabrication and erection of the systems, and all work shall be performed entirely by his own forces. No sub contract labour will be acceptable unless specified through written confirmation when required.
- ccxciii. Design approved metal framing members to accommodate expansion and contraction of components without buckling, creating stress on glass, structural components and fasteners, joint seals or other damaging effects when subject to a surface temperature range of 0-degree C to 50 degree c and interior temperature for 0 degree C to 30 degree C.
- ccxciv. Within two weeks of signing this agreement the contractor shall provide a detailed write up on the following
 - dddd) Conceptual design
 - eeee) Componentandhardware description
 - ffff) Design,fabricationand executionmethodologies
 - gggg) Detailedbar chartandshowing allactivities frommacro to microdetails.
 - hhhh) Method statement.

PERFORMANCE REQUIREMENTS

Design Pressure

- ccxcv. Pressure used for design shall be satisfied code and shall not be less than the minimum code values specified.
- ccxcvi. Minimum design pressures both inward, outward and acting perpendicular to glass (including return surfaces) shall be as per the requirements the Indian Wind Loading Code IS 875 Part 3 and earthquake regulations.

Submittals

Shop Drawings

Prepare detailed shop-drawings incorporating all allowances for construction and fabrication tolerances.

- ccxcvii. Submit detailed shop drawings for the four way semi unitized curtain wall system or Approved Equivalent, conventional curtain wall, aluminum composite panels cladding works, to Project Manager/appropriate government authority appointed by GSCDL for review.
- ccxcviii. Submit preliminary shop drawings with tender drawings showing all major curtain wall system components and junction details.
- ccxcix. Architect's review will be conformance to the design concept and for the general arrangement only.
And such review shall not relieve the contractor of any responsibilities as stated herein or any other applicable items herein specified.
- ccc. Submit shop drawings for all work of this section, including mock-up. Show joinery techniques, provisions for horizontal and vertical expansion, glass and metal thickness, framing and anchor member profiles identify all materials including metal alloys, glass types, fasteners and glazing materials identify all shop and field sealants by product name and locate on drawings show relative layout of all adjacent walls, beams, columns and slabs with all dimensions to each other and grid lines Dimensions position of glass edge relative to metal daylight Anchorage details to the building structure and coping details at the parapet are also to be submitted.
- ccci. Submit die drawings for all gaskets, weather strips and aluminum extrusions for record only and not for review.
- cccii. Shop drawings shall be signed and sealed by a Qualified Structural Engineers with specific experience in structural glazing wall construction and design.

Structural Calculations:

- ccciii. Submit for review structural calculations stamped and signed by a qualified structural engineer for all work of this section, including mock-up complying with current design rules of the relevant aluminum code include analysis for wind, dead loads, deflections and

if appropriate seismic loads on framing members and anchors. Show section property computations for framing members and full size detail drawings. The above should also be certified by the building structural engineer for deflection and structure adherence clearance.

- iiii) Existing test reports shall not be an acceptable substitute for computation.
- jjjj) In no case shall glass be considered as a lateral brace for the frame members.

ccciv. Submit structural calculations for the structural silicone joint size as required aluminum profiles, silicone gaskets and glass bite must accommodate the silicone joint size required.

Glass Analysis

Submit for record only glass manufacturer's wind pressure analysis, seismic load analysis and thermal analysis showing that the specified maximum deflections and probabilities of breakage are not exceeded.

Suitability for Structural Silicone Glazing

Submit for record only glass manufacturer's written statement that any insulated glass, reflective glass and spandrel glass supported by structural silicone is suitable for such application.

Structural Silicone Substrate Tests

Submit for review the results of the structural silicone substrate tests

Silicone Adhesive Tests

Submit for record only sealant manufacturer's test report for weather seal silicone adhesive to all relevant substrate. Test must include seven-day water immersion after which silicone must have excellent adhesion to substrates. Report adhesion strength in terms of shear stress and tensile stress. Test samples shall approximate sealant joint sizes and configurations intended for production materials

Certification

Submit a letter of certification from the sealant manufacturer stating that the sealant has been tested for adhesion and compatibility on production samples of metals, glass, and other glazing components, and that all sealant details and application procedures shown on the reviewed shop drawings are acceptable for use.

Samples

cccv. Within two weeks of signing the contract the contractor to submit samples for review three (3) sets of labeled samples of each required type and colour of metal finish, on 300 mm long sections, of aluminum extrusion shapes. Samples must show extremes of colour texture variation. Samples will be reviewed by Project Manager/appropriate government authority appointed by GSCDL for colour and texture only. Compliance with other

requirements is the responsibility of the Contractor. Colour and texture range of production material shall match approved samples.

- ccvii. Project Manager/appropriate government authority appointed by GSCDL reserves the right to require samples which will show the fabrication techniques and workmanship of the component parts, the design the accessories and other exposed auxiliary items before fabrication of this work proceeds.
- cccviii. Within two weeks of signing this contract submit for review, 3 sets of samples sealant, backers, anchor components, anchor assemblies and epoxies.

ALUMINUM COMPOSITE PANEL

Materials

- cccviii. Aluminum composite panel shall consist of two aluminum sheets (A 3003 – H 16 or H 14) and antitoxic polythene. The thick of the aluminum sheet shall be 0.5 mm thick and antitoxic polythene 3 mm thick.
- cccix. Aluminum composite panel shall be coated with PVDF coating kynar 500 in standard approved colour.

Standard Panel Size

Product Range	Specification
Aluminum composite panel	Thickness 3, 4 and 6 mm
Core	Antitoxic polythene
Width	1020 mm 1250 mm 1575 mm
Length	Max. 8000 mm

Product Tolerance

- cccx. Width : +or – 2.0 mm
- cccxi. Length : + or – 4 mm
- cccxii. Thickness : + or – 0.2 mm for 3 mm and 4 mm+ or – 0.3 mm for 6 mm
- cccxiii. Bow : Maximum 5% of the length and or width
- cccxiv. Squareness :Maximum 2 mm
- ccc xv. Surface defect :The surface shall not have any irregularities such as roughness, buckling and otherimperfection. Aluminum composite panel shall be supplied with protective film on panel surface.

Mechanical properties of Cover sheet:

- cccxvi. Thickness : 0.5 mm aluminum (A 3003 – H 16)
- cccxvii. Density : 2.72 Kg / Sqm
- ccc xviii. Tensile strength : Rm > 140 N/mm²
- ccc xix. 0.2 %Roof stress : Rp 0.2 > 100 N/mm²
- ccc xx. Elongation 50 mm :A50 > or = 1%

Table 6: General Properties of Aluminum composite panel

ITEM	ASTM	UNIT	4 MM
Unit weight		Kg/Sqm	5.6
Tensile strength	E 8	Kg/mm ²	4.99

ITEM	ASTM	UNIT	4 MM
Yield strength	E 8	Kg/mm ²	3.91
Elongation	E 8	%	7.3
Flexural Rigidity (20 cm span)	C –393	Kg/mm ²	8.6
Flexural Elasticity		Kg/mm ²	3222
Thermal expansion	D –596	10 /C	148
Thermal conductivity	D – 976	Kcal/mhrC	3.49
Deflection temperature	D – 648	C	30 to 80 C
Bond integrally	C – 297	1bf/in	42.56

Properties Of Painted Finish

Aluminum composite panel (painted) with fluoro carbon coating with Kynar 500 base, to meet following criteria.

Film Property	Test Method	Comments
Color Retention	ASTM D-2244-93	□ E5 less
Gloss Retention	ASTM D-523-89	
Chalking	ASTM D-4214-89	8 unit
60Gloss	ASTM D-523-89	20 – 30
Pencil Hardness	ASTM D-3363-92 a	H.F.
Formability (T-bend)	ASTM D-1737-62	IT No creak
Adhesion Dry Wet Boiling water	ASTM D-3359, Method 6 37.8 C, 24 Hrs 100C, 20 Min.	No change
Reverse impact – Crosshatch	NCCA 11-5	No adhesion
Abrasion Resistance	ASTM D-968-93 (Falling sand)	No change
Salt spray Resistance: 100% Salt fog 35 C 3000 hrs	ASTM D-8117-90	No change
Humidity Resistance 100% RH 35 C 3000 Hrs.	ASTM D-2247-94	No change
Chemical Resistance HCL H ₂ SO ₄ Mortar Detergent	ASTM D-1308-87 ASTM D-1308-87 AAMA 605-2-90 ASTM D-2248-93	No change

Workmanship

The cladding and framing are to be designed to withstand a wind velocity of 100 Kg/Sq.mt. The contractor must guarantee that this product will comply BS-4315 Part I and meet the following conditions.

- cccxi. Elements to suffer no residual distortion or other damage when subjected to a test pressure positive and negative of 1530 N/Sqm. Framing members shall not deflect beyond 1/175 of the span under condition when subjected to afore mentioned load.
- cccxii. Aluminum composite panel duly pre-fabricated on HOLZER Machine, shall be fixed on aluminum substructure.
- cccxiii. No gross leakage through the system up to a test pressure of 1500 N/m² (150 mm H₂O).
- cccxiv. Air infiltration shall be not greater than 2 m³/h per Metre length of peripheral joints between glass. Air infiltration must not exceed 2 m³/h per Metre length of opening joints to opening vent windows.
- cccxv. All screw or bolt connection must be concealed from view unless specified.
- cccxvi. Component shall be assembled and sealed in a manner that allows for thermal movement of the cladding etc., and structure without risk or buckling are distortion.
- cccxvii. Noiseless movement of all components in the system due to expansion and contraction must be achieved. Anchorage to structure must not restrict such movement described and must also allow for creep deflection in building frame which must not impose local stress resulting in buckling and distortion of component members.

Cleaning

The PVC tape wrapping, protecting the anodized finish shall be retained till the panel work is completed. After the panelling and work connected with installation is complete, all aluminum panels shall be washed with suitable thinner and left in a suitable condition, approved uniform appearance free from all marks and blemishes. Ensure that cleaning methods and solution used will not be determined to any element of the structural panelling system.

Guarantee

The contractor has to obtain back to back guarantee from the manufacturers of the various components of aluminum composite panel cladding system. These guarantees shall be submitted to the Architect/ Project manager/ appropriate government authority appointed by GSCDL for the purpose of ensuring that all party in connection with execution of this work will be ultimately responsible for whatsoever defects noticed during the warranty period.

ANTI-TERMITE TREATMENT

The buildings shall be adequately protected against attack by subterranean termites by suitable chemical treatment measures. The work shall be carried out by a specialist pest control agency approved by the Project manager/ appropriate government authority appointed by GSCDL.

The work to be carried out by the specialist firm shall carry a guarantee for the satisfactory performance of the treatment for a minimum period of 10 years.

The treatment shall be carried out generally in accordance with the stipulations laid down by IS 6313 (Part – II) –1971 (code of practice for anti-termite measures in buildings - Part II- preconstruction chemical treatment measures) subject to the minimum requirements given in these specifications.

Providing and injecting chemical emulsion for pre - construction ant termite treatment as per I.S.6313. (Part – I & Part – II) specification and creating a chemical barrier in bottom and sides of foundation trenches, top- surface of plinth filling junction of walls and floors along with external perimeter of the building expansion joints surrounding the pipes and cables etc. complete using approved quality of chemical emulsion of requisite quantity prescribed by the manufacturer as directed by the Project Manager/appropriate government authority appointed by GSCDL including cost of all materials and labour taxes etc. complete.

Minimum Specifications

The earth filling immediately under the stone soling (under floors) bottom and side fills of all foundations (excepting foundations) and soil along external perimeter of all buildings shall be chemically treated against termites. The chemicals to be used for the treatment shall be Choropyriphos 20% E.C. conforming to the requirement and concentration laid down in IS 6313 (Part-II) 1981.

The chemical solution shall be prepared by mixing the chemical with the appropriate quantity of water to obtain a chemical emulsion of the correct concentration as stipulated above. The prepared emulsion shall be applied as described below.

Column pits, wall trenches, etc.

The bottom surface and sides of the excavations (up to a height of 30 cm from the bottom) made for column foundations, wall foundations etc. (excepting RCC foundations) shall be treated with the chemical emulsion at the rate of 5 litres per Sqm of surface area.

Treatment to Backfill

After the column foundations, wall foundations etc. come up the back fill in immediate contact with the foundation structure shall be treated @ 15 litres –per Sqm of the surface of the sub-structure for each side. If water is used for ramming operation is completely by roding earth at

15cm.centres close to the wall face and spraying the chemical with the above doze. The earth is to be returned in layers and the treatment shall also be carried out in similar stages. The chemical emulsion shall be directed towards the masonry wall surfaces so that the earth in contact with these surfaces is well treated with the chemicals.

In the case of RCC walls and columns, the treatment shall start at the depth of 50cm below natural ground level. From this depth the back fill around the RCC columns, walls etc., shall be treated at the rate of 15 litres per Sqm of the surfaces.

Top Surfaces of Plinth Filling

The top surface of the plinth fill (just below the stone soling) shall be treated with chemical emulsion at 5 Litres per Sqm of the surface before the stone laid. If the filled earth has been well consolidated and does not permit the emulsion to seep through, holes up to 50 to 75mm deep at 150mm centres both ways may be made with crowbars to facilitate saturation of the soil with the chemical emulsion.

Junction of Wall and Floor

A channel of size 3 x3 cm shall be made at all the junctions of walls and columns with the floor (before laying the soling) and rod holes made in the channel up to the ground level at 15 cm centres. The solution is poured into the channel@ 15 litres per Sqm of the vertical surface and allowed to soak through the holes fully so that the solid in contract with the chemical. The soil shall be tamped back into the channel and consolidation to original conditions.

External Perimeter of Building

After the building is complete, holes shall be made along the external perimeter of the building at intervals 15cm and depths of 30cms and the emulsion shall be allowed to soak through these holes fully at the rate of 5 litres per R.M. of the perimeter wall.

Soil Surrounding Pipes

Wherever may service pipes enter the soil inside the area of the foundation of any building, the soil surrounding the point of entry of each pipe at the foundation, floor etc., shall be fully soaked with the chemical solution for a distance of at least one meter from the point of such entry.

Expansion Joints

Soil beneath expansion joints at ground floor level shall be specially treated as directed. The joint itself shall also be treated as directed by the Project Manager/appropriate government authority appointed by GSCDL.

Treatment under Apron

The soil below the concrete for stone aprons to be provided around the perimeter walls of all building shall also be treated with the chemical solution @ 5 litres per Sqm.

Treatment over DPC

Top of concrete damp proof course in external and internal walls shall be given a liberal coat of chemical solution when the concrete is still green.

Spraying Equipment

To facilitate proper penetration of the chemical into the soil, a pressure pump of adequate capacity and sprayers shall be employed to apply the solution.

MISCELLANEOUS ITEMS

Brush Bond

Surface should be cleaned from oil, grease, wax, dirt and any other foreign material spelled and deeply disintegrated concrete should be removed to sound concrete and repaired. This has 2 components, brush bond powder and NITO bond BB acrylic emulsion.

Then the NITO bond BB is poured into a plastic or metal drum to this an equal volume of clean water is added. Then mixing is started with a slow speed drill (350 –450 RPM). The powder component is added gradually to the liquid avoiding lump formation and mixed for 2.3min, Mix and use, do not mix none material.

Then the material will be applied on the surface by mixing a short, stiff bristle brush, preferably 100 to 150mm wide. Apply with a paint in 2 coats.

Cinder Concrete Filling

General: This specification covers the requirement for filling under flooring of toilets, balconies etc. This shall generally conform to the specifications No.TS.3

Materials: Cinders shall be obtained from furnace of steam boilers using coal fuel only. It shall be cleaned and free from clay dirt, wood ashes or other deleterious matter. It shall be 12.5mm nominal size i.e. passing through IS sieve designation 22 micron and 70 to 90 percent retained on IS sieve designation 106 micron. Cinder obtained from brick kiln shall not be used.

Preparation of Mix: Cement and cinder shall be measured separately by volume in the ratio of 1:15 unless otherwise stipulated in the description of the item. Cement used need not however be actually measured but a bag of cement of 50 Kgs shall be taken as Approved Equivalent to 0.35 cum in ingredients shall then be thoroughly mixed together so that the cinders are uniformly and completely with neat cement.

Laying: The top surface of the roof slab shall be thoroughly cleaned of all dust, dirt and other foreign matter. The cinder concrete shall then be laid and spread on the area to the required slope and well rammed with wooden therapies to give a uniform sponge concrete, correct to slopes and levels.

Curing: The finished surface shall be cured for at least 7 days. During this period it shall be protected from sun, rain and other damage.

ROAD WORK

Excavation over Areas

Excavation exceeding 1.5m in width as well as 10 Sqm area of plan and exceeding 30 cm depth in any type of soil and getting out.

Excavation in Trenches for Foundations and for Pipe etc.

Excavation in trenches for foundations of drains and for culverts (pipes) etc., not exceeding 1.5m width and not exceeding 10 Sq. mt. on plan will be excavation in trenches in any type of soil and getting out.

Surface Dressing

Uneven surfaces of the natural ground, rough excavated surfaces and filled up area where ordered shall be trimmed to an even surface horizontal or slopping by removing vegetation and by scraping high patches and filling in low patches with the scraped soil to give an even and neat look to the site. The maximum depth of cutting shall not exceed 15 cm in any type of soil.

Filling Sides of Trenches, Trenches of Pipe

- cccxxviii. As soon as the masonry drain work/foundation has been completed and measured, the space around the foundation masonry in trenches shall be cleared of debris, brick bats etc., and filled with selected earth in layers not exceeding 250mm, each layer being watered, rammed and compacted before the succeeding one is laid. Earth shall be rammed with iron rammer where feasible and with butt ends of crowbar where rammer cannot be used.
- cccxxix. Filling in trenches of pipes shall be only after the joints of pipes and drains have been tested and passed by Project Manager/appropriate government authority appointed by GSCDL.

Earth Filling for Embankment

- cccxxx. Clearing of Site: Prior to commencement of earthwork, the site shall be cleared of obstruction and vegetation including trees, roots, under growth, grass, rubbish etc. All stumps shall be cut down below the ground level as specified. Embankment for road work etc., shall be set out to true to alignment, gradient, camber, super elevation etc., as indicated or as directed by Project Manager/appropriate government authority appointed by GSCDL.
- cccxxxi. Compacting Original Ground: - Original ground shall be compacted as much as reasonably possible for rolling or by other means like tamping where rolling is not feasible. All empty pockets or depression left in the soil as a result of clearing and grubbing operation shall be filled and compacted. Any unsuitable material occurring in the embankment foundation shall be replaced by approved material.

cccxxxii. Only approved earth shall be used for embankment. The work shall be executed that the best available earth is saved for the top portion of embankment. Earth shall be deposited in layers not exceeding 25 cm. For adequate compaction the embankment shall be constructed in uniform layers spread over entire width of embankment width. Successive layers shall not be placed unless layers under construction have been thoroughly compacted to satisfy the specified requirement.

Compaction

Each layer shall be thoroughly compacted with power road roller of weight not less than 8 tonnes till the soil behaves as an elastic material and gets compressed under the load of roller. In Location where consolidation by power roller is not possible, manually or mechanically operated rammer shall be employed for compaction. The embankment shall be finished to the lines, grade and cross section as directed. The compaction of earth in embankment shall be carried out under optimum moisture conditions so as to obtain at least 95% of standard proctor density for each layer. Dry density shall be determined in accordance with IS-

2720 part (vii) 1980. Method of tests for soils part (vii). Determination of water content-dry density relation using light compaction. The moisture content of each layer of soil at the time of compaction should be 1% above to 2% below the moisture content. At all times during construction, the top of embankment shall be maintained at such a cross fall as well shed water and prevent ponding. To allow the subsequent settlement of embankment, the finished level of embankment shall be set higher than the specified level by 1-2% of the height of embankment.

Precast Concrete for Kerbs

Precast concrete kerbs shall be of the grade M-200 as shown in drawings and cast in forms or moulds. The forms shall be of steel for better finish. The contractor is to precast the units on cement or steel platform, it shall be adequately oiled provided the surface finish is of the same standards as obtained in the forms. Concrete shall be mixed, placed in position and thoroughly compacted by vibrator or tamping to give a dense concrete free from voids and honey combing. All angles of the precast units with the exception of the angles, resulting from the splayed or the chamfered faces shall be true right angles. The arises shall be clean and sharp except those specified are shown to be rounded. The wearing surfaces shall be true and out of wind up. On being fractured the interior of units shall present a clean, homogeneous appearance.

Maturing

From the date of casting, precast concrete kerbs shall be matured for 28 days before fixing, concrete shall have sufficient strength to prevent damage to kerbs when handled.

Road Work: Soling

Materials: Stone for soling (sub-base) shall be granite, stones shall be broken to size range 100mm to 150mm. Stones shall be obtained from approved quarries as indicated.

Workmanship

The edges of soling shall be marked out by strings and stakes carefully ranged. Broken stones/ boulders shall be spread uniformly and evenly upon the prepared base, surface carefully trued up and high and low spots corrected by removing or adding broken stones as may be required and hand packed. The soling shall be consolidated by road roller 8 to 10 tonnes weight.

Rolling

After laying of course broken stones this shall be compacted to full width by rolling with 3-wheel power roller. Rolling shall begin from edges with roller running forward and backward until the edges have been compacted. The roller shall then progress gradually from edges to the centre parallel to the centre line of the road. Uniformly lapping preceding rear wheel track by one half width. Rolling shall be discontinued when the aggregate is partially compacted with sufficient void space in them to permit application of screenings. Compaction shall be continued until the aggregates are thoroughly keyed with no creeping of stones ahead of roller. Sprinkling of water may be done where sub-grade is soft or yielding nor when it causes a wave like motion in a base course or sub-grade. If irregularities that develop during rolling exceed the limits specified the surface shall be loosened and aggregate added or removed as required before rolling again so as to achieve a uniform surface conforming to desired cross section and grade. The surface shall also be checked transversely by template for camber and any irregularities corrected in a manner described above. In no case shall the use of screening to make up depressions be permitted.

Application of Screening

After coarse aggregate have been rolled as per above, screenings to fill the interstices shall be applied gradually over the surface. Dry rolling shall be done while the screening are being spread so that the jarring effect of roller causes them to settle into voids of coarse aggregate. The screening shall not be dumped in piles but applied uniformly at a slow rate in 3 or more applications as necessary, until no more screening can be forced into the voids. This shall be accompanied by rolling and brooming. Either mechanical brooms/hand brooms or both may be used. In no case shall the screenings be applied so fast and thick as to form cakes or ridges on the surface making the filling of voids, difficult or preventing the direct bearing of roller on the coarse aggregate. The spreading, rolling and brooming of screening shall be taken up on sections which can be completed within one day's operation. Damp and wet screenings shall not be used in any circumstances.

After application of screenings the surface shall be copiously sprinkled with water, swept and rolled. Hard brooms shall be used to sweep the wet screenings into the voids, and to distribute them evenly. The sprinkling, sweeping and rolling operations shall be continued and additional screenings applied where necessary until the coarse aggregate are well bonded and firmly set for the entire depth. Care shall be taken that the subgrade or sub-base does not get damaged due to addition of excessive quantities of water during construction.

cccxxxiv. Coarse Aggregate

General Requirements

cccxxxv. Coarse Aggregate shall be either crushed or broken stone.

cccxxxvi. The aggregate shall conform the following physical requirement.

Sl. No.	Type of Construction	Test	Test method	Requirement
1.	Sub-base	a) Los Angeles Abrasion value OR Aggregate impact value	IS 2386 Part IV IS 2386 Part IV OR IS 5640	Max 60% Max 50%
2.	Base Course	a) Los Angeles Abrasion Value OR Aggregate impact value b) Flakiness Index	IS 2386 Part IV IS 2386 Part IV OR IS 5640 IS 2386 Part I	Max 50% Max 40% Max 15%

NOTES:

1) Aggregate may satisfy requirements of either Los Angeles test or Aggregate impact value test.

2) The requirement of Flakiness test shall be enforced only in the case of crushed broken stone.

Crushed Broken Stone

Crushed broken stone shall be hard, durable and generally free from flat, elongated, soft disintegrated particles. It shall also not have excess of that or other objectionable matter.

Size and Grading Requirements

Coarse aggregates shall conform to the following grading as indicated.

Grading no.	Size range	Sieve designation	Percentage of Weight passing the sieve
1	90mm to 45mm	125mm	100%
		90 mm	90-100%
		63 mm	25-65%
2	63mm to 45mm	45 mm	0-15%
		22.4 mm	0-5%
		90 mm	100%
3	53mm to 22.4 mm	63 mm	90-100%

Grading no.	Size range	Sieve designation	Percentage of Weight passing the sieve
		53 mm	25-75%
		45 mm	0-15%
		22.4 mm	0-5%
		63 mm	100%
		53 mm	95-100%
		45 mm	65-90%
		22.4 mm	0-10%
		11.2 mm	0-5%

Screenings

Screenings to fill voids in the coarse aggregate shall generally be of the (same material) broken stone. As the coarse aggregate predominantly non plastic material, such as Moorum or gravel may also be used where indicated, for this provided the liquid limit and plasticity index of such materials is below 20 and 6 respectively and fraction passing 75-micron sieve does not exceed 10%.

Screenings shall conform to the grading shown under.

Grading classification	Size of screening	Sieve designation	Percent by wt. Passing the sieve
A	13.2mm	13.2mm 11.2mm 5.6mm 180.0 micron	100 95-100 15-35 0-10
B.	11.2mm	11.2mm 5.6mm 180.0 micron	100 85-100 10-30

Screenings of type A shall be used in conjunction with coarse aggregate of grading 1 and of type B with coarse aggregates of grading 3 with coarse aggregates of grading 2 either type A or type B screenings may be used. For screenings like Moorum of the gravel the grading given are not binding.

Water bound macadam used as base course shall be constructed with 50 – 20 mm size grading 3 where indicated.

Preparation of Foundation

- cccxxvii. The sub base to receive water bound macadam course shall be prepared to the required grade and camber/slope and cleaned of all dust, dirt and other extraneous matter, any

ruts or soft yielding places that have appeared due to improper drainage, service under traffic or any other reason shall be corrected and rolled until firm.

cccxxxviii. In all cases the foundation shall be kept drained during construction operation.

cccxxxix. Before starting with W.B.M. construction necessary arrangements viz., well tamped clay bund or fillets about 15 cms wide and to the height required shall be made for the lateral confinement of aggregate.

Spreading of Coarse Aggregate

cccxl. The coarse aggregate shall be spread uniformly and evenly upon the prepared base in required quantity from stock piles along the side of road. In no case shall these be dumped in heaps directly on the area where these are to be laid, nor shall there hauling over a partly completed base be permitted. The aggregate shall be spread to proper profile by using templates placed across the roads about 10 M apart.

cccxli. The W.B.M. course shall be normally constructed in the layers of not more than 75mm compacted thickness. Each layer shall be tested by depth blocks. No segregation of large and fine particles shall be allowed, the coarse aggregate as spread shall be of uniform gradation with no pockets of fine material.

cccxlii. The coarse aggregate shall normally not be spread in lengths exceeding three days average work ahead of the rolling and bonding of the preceding section.

Rolling

cccxlili. After the laying of the coarse aggregates these shall be compacted to full width by rolling with either three wheel power roller of 8 to 10 tonnes weight and vibratory roller.

cccxliv. Rolling shall begin from edges with roller running forward and backward until edges have been compacted. The roller shall then progress gradually from edges towards the centre. Parallel to the centerline of the road. Uniformly lapping each preceding rear wheel track by one half width. Rolling shall be continued in the aggregates partially compacted with sufficient void space in them to permit application of screenings. Compaction shall be continued until the aggregates thoroughly keyed with no creeping of stone ahead of roller. Slight sprinkling of water be done during rolling.

cccxlv. On super-elevated portion of rolling shall commence from the lower edge and progress gradually towards the upper edge of the pavement.

cccxlvi. Rolling shall not be done when the sub grade is soft or yielding not when it causes wave like motion in the base course or sub grade. If irregularities that develop during rolling exceed the limit specified, the surface shall be loosened and aggregates added or removed as required before rolling again so as to achieve uniform surface conforming to the desired cross section and grade. The surface shall also be checked transversely by template for camber/slope and any irregularity corrected the manner described above. In no case shall be use of screenings to makeup the depressions permitted.

Application of Screenings

After the coarse aggregate has been rolled. Screenings to fill the interstices shall be applied gradually over the surface. Dry rolling shall be done when the screenings are being spread so that the jarring effect of rolled causes them to settle into voids of coarse aggregate. The screening

shall not be dumped in piles but applied uniformly at slow rate in three or more applications as necessary, until no more screenings can be forced into voids. This shall be accompanied by rolling and booming. In no case shall screenings be applied so fast and thick as to form cakes or edges on the surface making the filling of void difficult or preventing the direct bearing of roller on the coarse aggregates. The spreading, rolling and brooming of screenings shall be taken up on sections, which can be completed within one day's operation.

Sprinkling and Grouting

After application of screening the surface shall be copiously sprinkled with water, swept and rolled. Hand brooms shall be used to sweep the wet screenings into the voids and to distribute them evenly. The sprinkle, sweeping and rolling operations shall be continued and additional screenings applied where necessary until the coarse aggregates are well bonded and firmly set for entire depth and a grout of screenings and water forms ahead of the wheels of the roller, care shall be taken that the sub base does not damage due to addition of excessive quantity of water during construction.

Application of Binding Material

After the application of screenings, sprinkling and grouting, binding material where it is required to be used shall be applied at a uniform and slow rate in two or more successive thin layers. After each application of binding material, the surface shall be copiously sprinkled with water and the resulting slurry swept in hand brooms to fill the voids properly. This shall be followed with 8 to 10 roller, during which water should be applied to the wheels to wash down the binding material that may be struck to them. The spreading of binding material, sprinkling of water, sweeping with brooms and rolling shall continue until the slurry of the binding material and water forms a wave ahead of the wheels of the moving roller and a wave of grit is formed ahead of the wheels of roller.

Setting and Drying:

After final compaction of the coarse W.B.M., the road shall be allowed to cure overnight. Hungry spots shall be filled with binding material lightly sprinkled with water, if necessary and rolled. No traffic shall be allowed till the macadam sets.

Surface Evenness of W.B.M. Course

The finished surface shall be checked for line, level and regularity. The surface evenness of completed W.B.M. course in longitudinal and transverse section shall be within tolerance specified as under.

Sl. No.	Type of construction	Longitudinal profile with 3 M straight edge		Cross profile
		Max. permissible Undulation	Max. No. of undulations in any 300m length	Max. permissible variation in from specified profile under camber template
1.	Sub grade (cut formation, earthen embankment)	24 mm	(18mm) 30	15 mm
2.	Soling	20 mm	(16mm) 30	12 mm

3.	W.B.M. with normal size metal 20 to 50 mm	12 mm	(10mm) 30	12 mm
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Rectification of Defective Construction

Where the surface irregularities of W.B.M. course exceed the specified tolerance or the course is otherwise defective due to sub grade soil mixing with aggregates. Layer to the full thickness shall be scarified over the affected area, reshaped with added material, or removed and replaced with fresh material as applicable and re-compacted. The area treated in the aforesaid manner shall not be less than 10 Sqm. In no case depressions be filled with screenings or binding material.

Road Work–Premix Carpet

Aggregate for Bituminous Carpet

Aggregates shall consist of crushed stone, as specified, and shall have clean, strong durable and fairly cubical fragments free from disintegrated pieces, salt, alkali, vegetable matter, dust and adherent coatings. The aggregates shall preferably be hydrophobic in nature and of low porosity.

The Aggregates shall satisfy the following Physical Requirements.

Property	Value, Max, Percent
Los Angeles Abrasion Value	35
Aggregates Impact Value	30
Flakiness Index	25
Stripping Value	25
Water absorption	2

Sand

Fine aggregates or sand shall consist of natural sand or crusher run screenings or a mixture of both and shall be clean, hard, durable, uncoated, coarse dry particles, and be free from injurious amounts of dust, soft or flaky particles or organic matter or other deleterious substances.

Bitumen

- cccxlvi. Paving Bitumen
Paving bitumen shall conform to IS 73-1961, Specification for paving bitumen, shall be of the following two categories.
- cccxlviii. Preparation of Road surface
Surface to be primed shall be swept clean, free from dust, dirt or other deleterious matter by hand brushing, with wire brushing – basis brooms and finally by fanning the cleaned surface with gunny bags and for best results be dry. Large irregularities, pot holes-depressions etc., shall be repaired prior to priming. Minor depressions and hole may be ignored until after the surface is primed, after which they should be patched with suitable premixed materials prior to the surface treatment.
- cccclix. Application of Bituminous Primer.
Bituminous primer shall not be applied on a wet surface or during dust storm or when the weather is foggy or rainy. After the surface to be primed has been prepared, the bituminous primer shall be sprayed uniformly over the dry surface preferably using

mechanical sprayers. The primer shall be applied at the rate indicated. Recommended rates of application are given in the following table.

Grade of primer	Quantity per 10 sq. mt. in kg.
Primer for surfaces of low porosity	7.5 to 10
Primer for surfaces of medium porosity	10 to 12
Primer for surface of high porosity	12 to 14.5

Temperature of application of a primer need only be high enough to permit the primer to be sprayed effectively through the jets of the spray bar and to cover the road surface effectively. Generally it may vary from 40 degree to 80 C degree for the range of viscosities of the primers specified. Any pools of excess primer left on any part of the surface should be swept out over the adjacent surface, and then a light spreading of sand shall be applied.

- cccl. Curing
The primed surface shall be allowed to cure for not less than 24 hours or till it is cured. During this period, traffic shall be kept off of the primed surface.
- cccli. Tack Coat Binder
Binder used for tack shall be paving bitumen or cut back bitumen as indicated. Binder shall be of suitable grade.
- ccclii. Preparation of Surface
The surface on which the tack coat is to be applied shall be thoroughly swept and scrapped clean of dust and any other extraneous material before the application of the binder.
- cccliii. Application of Binder:
Binder shall be heated to the appropriate temperature and sprayed uniformly on the base at the rate specified. The tack coat shall be applied just ahead of the oncoming bituminous construction.
- cccliv. Preparation of base:
Before the carpet is applied to the existing based, the surface shall be cleaned by removing dirt, caked earth and other foreign matter with wire brushes, sweeping with broom and finally dusting with sacks. Where the existing base is potholed or rutted, these irregularities shall be corrected with premixed chippings or coated macadam as indicated.
- ccclv. Tack coat
The binder shall be heated wherever required to the temperature appropriate to the grade of binder used and applied uniformly to the base of the rates specified by means of a sprayer. The binder shall be evenly brushed, if need be. The tack coat should be applied just ahead of the spreading of the premix.
- ccclvi. Preparation of Premix.
Mechanical mixers of approved type shall be employed for mixing. The binder shall be heated to the temperature appropriate to grade of bitumen used. The paving bitumen is used, the aggregates shall be suitably heated before these are placed in the mixers. After about 15 Seconds of dry mixing the heated binder shall be distributed over the

aggregates at rates specified. The mixing of the binder with chippings shall be continued until the chippings are thoroughly coated with the binder.

ccclvii. Spreading of Premix

Immediately after the application of tack coat, the premix shall be spread evenly with rakes to the desired thickness and to the correct camber are distributed evenly by means of drags spreader. The surface shall then be checked for camber by means of camber board and all inequality corrected.

ccclviii. Rolling

As soon as the sufficient has been spread with the premix, the surface shall be rolled with 8 to 10 tonnes smooth wheeled power rollers or pneumatic tyre rollers. Rolling shall commence at the edge and progress towards the center longitudinally, except in the case of super-elevated curves, where rolling shall progress from inside towards the outside of the curve. When the roller has passed once over the whole area any high spots or depressions which become apparent, shall be corrected by removing or adding premixed chippings. When this has been done, the surface shall be rolled to compaction and all roller marks eliminated. Excessive rolling shall be avoided as this serves no useful purpose and may spoil the carpet. In each pass of the rollers and preceding track shall be overlapped uniformly by at least 1/3 width. The roller wheels shall be kept damp to prevent the premix, adhering to wheel and being picked up. Fuel and lubricating oil shall not be used for this purpose. Longitudinal and transverse edges of the carpet laid and compacted earlier shall be cut to their full depth so as to expose fresh surface, it shall be painted with a thin surface coat of binder before new mix placed against it.

kkkk) Premixed sand sealcoat

llll) Sand for premix sand seal coat

mmmm) Sand or fine grid shall pass 1.75mm sieve and be retained on 180 Micron sieve.

nnnn) Premixed sand sealcoat

The Binder shall be heated to the temperature appropriate to the grade of bitumen being used. Also dry sand shall be suitably heated to the required temperature before it is placed in a mechanical mixer. Mixing of binder with sand to the specified proportion shall be continued till the sand is thoroughly coated with the binder. As soon as sufficient length has been covered with premix material, surface shall be rolled with 8 to 10 tonne power roller. Rolling shall be continued till the premix material completely seals the voids in the bituminous course and smooth uniform surface is obtained.

ccclix. Finished Surface

The finished surface shall be uniform and conform to the lines, grade and cross sections specified. The surface evenness of the compacted carpet in the longitudinal and transverse directions shall be within the tolerance specified.

ccclx. Opening to Traffic:

Traffic may be allowed on the road after providing the seal coat.

Flexible Pavement

Subgrade

Sub grade material and construction methodology shall be as per clause 305 of MORT&H technical specifications.

Sub grade shall be of specified thickness and lay in layers. Material shall satisfy the following requirement. California Bearing Ratio (CBR) value shall be 8.0% @ 98 % compaction. Plasticity Index (PI) not greater than 12.0. Liquid limit of material shall not be greater than 25. Compaction to 98% of MDD obtained from modified comp active effort.

Granular Sub-Base

Sub-base material and construction methodology shall be as per Clause 401 of MORT&H Technical

Specification.

Sub-base shall be of 250 mm thick and shall be laid in two layers of 125 mm thick each. Material shall satisfy the following requirements.

Granular sub-base material shall be as per clause 401.2 and grading I of Table 400 - 2 of MORT&H specification.

CBR value shall be 25% @ 98% compactions. Plasticity Index (PI) not greater than 6.0.

Compaction to 98% of MDD obtained from modified comp active effort.

Water Bound Macadam (WBM) Base - Course

Base course material shall be Water Bound Macadam (WBM) and Construction methodology shall be as per

Clause 404 of MORT&H Specifications.

Base course (WBM) shall be of 150 mm thick and shall be laid in two layers of 75 mm thick each. Material shall satisfy the following requirements.

Physical requirement shall be as per Table 400 - 6 of MORT&H Specification.

Grading requirements of course aggregates shall be as per grading 3 of Table 400 - 7 of MORT&H Specification.

Screening shall confirm to grading 3 of Table 400 - 8 of MORT & H specification .

Specification for Construction of Flexible Pavements

It is proposed to provide flexible pavement in the area around the building blocks. All the specifications given in this section are additional to and supplementing the relevant clauses (specifically clause 50] in 'Specifications for road and bridge works', (Third revision) published at New Delhi in 1995 (Reprinted in January 1998) by Indian Roads Congress on behalf of Government of India, Ministry of Surface Transport.

All guidelines given in IRC:37 – 2001 – "Guidelines for the design of flexible pavements" and other relevant IRC codes shall be followed in construction of cement concrete pavement. The details of flexible pavement are shown in annexure-H. If there is any discrepancy among the various

applicable codes / specifications / standards, then the decision of the Project Manager/appropriate government authority appointed by GSCDL. shall be final and binding.

The flexible pavement shall generally consist of the following layers:

- ccclxi. Subgrade
- ccclxii. Subbase (GSB)
- ccclxiii. Base (WMM)
- ccclxiv. Dense Bituminous Macadam (DBM)
- ccclxv. Asphaltic concrete (AC)
- ccclxvi. Tack Coat
- ccclxvii. Prime Coat

Pavement Specification

The various components of pavement and other road works shall be done as per the clauses of MORTH specifications indicated in the table below.

Table 7: Various components of pavement and other road works

S. No.	Component	Clause
1.	Subgrade	601.4
2.	Lean concrete sub base	601
3	Separation membrane	602.5
4	Cement concrete pavement	602
5	Joint filler	602.2.7
6	Joint Sealing Compound	602.2.8
7	Joints	602.6.1
8	Transverse Joints	602.6.2.1
9	Contraction Joints	602.6.2.2
10	Expansion Joints	602.6.2.3
11	Construction Joints	602.6.3
12	Longitudinal Joints	602.6.4
13	Dowel bars	602.6.5
14	Tie bars	602.6.6
15	Equipment	602.9.3
16	Sub base course for flexible pavement	401
17	Base course for flexible pavement	406
18	Prime coat	502
19	Dense bituminous Macadam for flexible pavement	507
20	Asphaltic concrete for flexible pavement	512
21	Tack coat	503

Note: Specifications for road and bridge works (Up-gradation of Third revision)– Upgraded section 500 and its related aspects in sections 900 and 3000 (addendum to Third revision), November 2000 shall govern the pavement construction.

Quality Control for Road Works

All materials to be used, all methods adopted, necessary tests to ensure quality and all works performed shall be strictly in accordance with the requirements of the specifications as per Clause 901 of 'Specifications for road and bridge works', (Third revision) published at New Delhi in 1995 (Reprinted in January 1998) by Indian Roads Congress on behalf of Government of India, Ministry of Surface Transport.

Joint Filler Compounds

Bitumen Board

The bitumen impregnated fiberboard, a performed material shall be used as joint filler, which shall fill space between the concrete surfaces at the joints. The minimum thickness of the board shall be 12mm and the material shall conform to IS: 1838.

Expanded Polystyrene

The expanded polystyrene slab shall be of fire retarding grade (type-2) conforming to IS 4671. Density of material shall not be less than 25kg/cum.

Sealing compounds

As per relevant IS Codes and as directed and approved by Project Manager/appropriate government authority appointed by GSCDL.

Bitumen Sealing Compound

The bitumen sealing compound shall be of form approved manufacturer and shall conform to the requirements of IS: 1834. For joints in concrete lining on canals/reservoirs, sealing compound conforming to IS: 5256 shall be used.

Polysulphide Sealing Compound

This shall be two-part Polysulphide sealant and shall be from approved manufacturer, conforming to IS: 12118. Materials shall consist of Polysulphide polymer and a curing agent. Gun grade material shall be used unless otherwise specified. The application of the sealant shall be strictly followed as per manufacturer's guidelines.

PLUMBING

Table 8: Technical Specifications For Plumbing

Sl. No.	Description
1.	General Provisions For Plumbing Installation
2.	Materials
3.	Underground Trenches
4.	Water Supply
5.	Valves And Pressure Gauges
6.	Appurtenances
7.	PVC Pipes And Fittings
8.	Stoneware (SW) Pipes And Fittings
9.	Mode Of Measurement
10.	Sewer Appurtenances
11.	Sanitary Fixtures And Installation
12.	Pumps

Table 9: List of IS Codes Relating to Plumbing Works

Vitreous	IS: 2556-1974
IS 2556-1981 (Part II)	IS: 2556-1984
Cast Iron Cistern	IS: 774-1984
Ball Valve	IS: 1703-1977
Cistern Brackets	IS: 775-1970
Toilet Seat Cover	IS: 2548-1983
Vitreous China Cistern	IS: 2326-1987
Sand Cast Iron Pipes & Fittings	IS: 1729-1979
Spun Cast Iron Pipes & Fittings	IS: 3989-1984
GI Pipes	IS: 1239-1979
Galvanizing for GI pipe	IS: 4736-1986
Pipe Threads	IS: 554-1985
Malleable Iron Fitting	IS: 1879-1987
Cast Iron Sluice Valves	IS: 780-1984
Full way valves	IS: 778-1984
Brass Ferrule Stone	IS: 2692-1978
Ware Gully Trap	IS: 651-1980
R.C.C. Pipes	IS: 458-1971
Cast Iron Class L.A. Pipes	IS: 1536-1989
Cast (Spun) Iron Fittings	IS: 1538-1976
Pig Lead	IS: 782-1966
Induction Motors	IS: 4691 / IS 325 / IS 4029

General Provisions for Plumbing & Sanitary Systems Installation

Scope of Work

The General character and the scope of work to be carried out under this contract is illustrated in the drawings and specifications attached herewith. The contractor shall carry out and complete the said work under this contract in every respect in conformity with the rules and regulations every respect in conformity with the rules and regulations of the local authority. The contractor shall furnish all labor, supply and installation of all materials, appliances, tools equipment necessary for the complete work and testing the whole plumbing services installation as specified herein, as per the relevant IS codes, and as shown in the drawings. This also includes any materials, appliances, equipment not specifically mentioned herein or noted in the drawings as being furnished or installed which are necessary and customary to make a complete installation properly connected and in working order shall have the necessary approvals from the client both in terms of rate & responsibility.

In general, the work to be performed under this contract shall comprise of the following:

- ccclxviii. All incidental works connected with plumbing services installation such as excavation of trenches and back filling, cutting and chasing in concrete and brick and making good, cutting/drilling holes through walls, floors, and grouting for fixing of fixtures/equipment, etc.
- ccclxix. Furnish and install a complete workable plumbing services installation as shown on the drawings and described in this specification and as per the latest IS specifications including all that which is reasonably inferred.
- ccclxx. Installation of internal system of water supply completely.

IS 651– 1980	Specification for Salt Glazedstonewarepipes andfittings (firstrevision).
IS 782– 1979	Specification forcaulkinglead
IS 1172 – 1983 & IS 1239 – 1990 (PartI)IS 1239–1992 (PartII)	Codeofbasicrequirements for watersupply,drainage&sanitation (revised). Specificationsformild steeltube, tubular and other steelfittings.: Specificationsformildsteeltube, tubular and other steelfittings.
IS 1726 – 1974	Code forcast ironmanholeframe and cover
IS 1729 – 1979	SpecificationforSandcastIronSpigotand ventilating pipes,fittings and accessories
IS 1742 – 1983	Code ofpractice forbuilding drainage
IS 2064 – 1973	Codeofpractice forselection,installationandmaintenanceofsanitary appliances
IS 2065 – 1983	Code of practice for water supply to buildings. IS 3114 – 1985 : Code of practice for layingCI pipes.
ISI8329&IS 9523	Ductile iron Watersupplyand Irrigation&Fittings
IS 4111 – 1986	Code ofpractice forconstruction ofsewer appurtenances
IS 7834	Specification ofun-plasticized PVC fittings.
IS 4985–1988	Specification for un-plasticized PVC pipes for potable water supplies
IS 13592 -1998	Specification for UPVC pipes SWRgrade

- ccclxxi. Installation of internal drainage and sewerage appurtenances all-round the building completely
- ccclxxii. Installing all Sanitary and plumbing fixtures completely.

- ccclxxiii. Installation shall be done in co-ordination with other agencies. Contractor shall remove any work done without regard or consultation with other trades, consultants without additional cost to the Employer, to permit the proper installation of all other work, as desired by the Project Manager/appropriate government authority appointed by GSCDL.
- ccclxxiv. Repair all damage done to the premises as a result of this installation and remove all debris left by those engaged for this installation to the satisfaction of Project manager/ appropriate government authority appointed by GSCDL.
- ccclxxv. Cleaning of all plumbing fixtures, testing and proving the satisfactory performance of all fixtures at the time the building is handed over to the Project manager/ appropriate government authority appointed by GSCDL.
- ccclxxvi. It is the responsibility of the contractor to take care of all the fixtures fitted until the time of handing over to the Project manager/ appropriate government authority appointed by GSCDL.
- ccclxxvii. Painting of all concealed and exposed pipes as specified.
- ccclxxviii. Assume full responsibility of all required applications and costs to connect to corporation watermains, sewers and storm water drains, to the extent these are applicable to this installation.

Regulations and Standards

The installation shall conform in all respects to the following standards in general:

The system shall in general be installed in accordance with National building code for water supply, drainage and sanitation. Part IX Plumbing services section 1 & 2 and SP 35 Hand book on Plumbing and Sanitary.

The installation shall also be in conformity with the byelaws and requirements of the local authority in so far as these become applicable to the installation. Wherever this specification calls for a higher standard of materials and/or workmanship than those required by any of the above regulations and standards, then this specification shall take precedence over the said regulations and standards. Wherever drawings and specifications require something that may violate the regulations, the regulations shall govern.

Fees, Permits and Notices

Contractor shall comply with all bye-laws and regulations of local and other statutory authorities having jurisdiction over the works and shall be responsible for the payment of all fees and other charges and giving and receiving of all necessary notices. Contractor shall keep the Project manager/ appropriate government authority appointed by GSCDL. timely informed about regulations and requirements of statutory authorities and shall obtain the final certificates of inspection and approval from the authorities.

Drawings and Specifications

The drawings and specifications shall be considered as part of this contract and any work or materials shown in the drawings and not called for in the specifications or vice versa shall be executed as if specifically called for in both. The tender drawings indicate the extent and general arrangement of the fixtures, drainage system, etc. and are essentially diagrammatic. The drawings indicate the points of supply and termination of work shall be installed as indicated in the drawings. However, any changes found essential to co-ordinate with this work or other trades

shall be made without any additional cost. The drawings and specifications are for the assistance and guidance of the contractor, and exact location, distance and levels will be governed by the individual building and site conditions, therefore approval of the Architect/Project manager/ appropriate government authority appointed by GSCDL shall be obtained before commencement of work. After execution of the works, contractor shall furnish one set of 'marked up' drawings showing the installation as built, where the originals are the issue of the Engineer and incorporated on the "Originals". In case the original drawings are issue of the contractor, then the contractor shall furnish a new set of "As built" drawings.

Manufacturer's Instructions

Where manufacturers have furnished specific instructions relating to the materials used in this job and methods of construction that are not specifically mentioned in these documents, such installations shall be followed in all cases.

Materials

- ccclxxix. Materials shall be of the best quality approved obtainable and unless otherwise specified they shall conform to the respective Bureau of Indian Standard Specifications.
- ccclxxx. Samples of all materials shall be as per the list of approved brand manufacture, which shall be got approved before placing order and the approved samples shall be deposited with the Project manager/ appropriate government authority appointed by GSCDL.
- ccclxxxi. In any case of non-availability of materials in metric sizes, the nearest size of FPS units shall be provided with prior approval of the Architect/ Project manager/ appropriate government authority appointed by GSCDL, for which no extra cost will be paid.

Underground Trenches

Alignment and Grade

The drains are to be laid to correct alignment and grade shown in the drawings but subject to such modifications as necessary to meet the requirements of the works. No deviations from the lines, depths of cutting or gradients of sewers shown in the plans and sections shall be permitted except by the express directions in writing of the Project Manager/appropriate government authority appointed by GSCDL.

Opening Out Trenches

In excavating the trenches, the road metal, pavement curb, etc., are to be placed on one side and preserved for reinstatement and the trench or other excavation shall be filled up and laid back to original condition at no extra cost.

Before any road metal is replaced, it shall be carefully shifted. The surface of all trenches and holes shall be restored and maintained to the satisfaction of the Project manager/ appropriate government authority appointed by GSCDL. the contractor shall not cut or break down any live fence or trees in the line of the proposed works but shall tunnel under them unless the Project manager/ appropriate government authority appointed by GSCDL. orders to the contrary. The contractor shall scrub up and clear the surface over the trenches and other excavations of all stumps, roots and other encumbrances affecting execution of the work and shall remove from the site to the approval of the Project Manager/appropriate government authority appointed by GSCDL.

Excavation to be taken to Proper Depth

The trenches shall be excavated in all conditions of soil and to such a depth that the sewers & water supply pipe lines shall reset as described in the several clauses relating thereto and so that the inverts may be at the levels given on the section. In bad ground, the Project manager/ appropriate government authority appointed by GSCDL. may order the contractor to excavate to a greater depth than shown in the drawings and to fill up the excavation to the level of the sewer with concrete, sand, gravel, or other materials. For such works the contractor shall be paid extra at the rates laid down for such works in the schedule, if the extra work ordered by the Employer/Project manager/ appropriate government authority appointed by GSCDL in writing. But if the contractor should excavate the trench to a greater depth than is required without a specific order to that effect in writing of the Project manager/ appropriate government authority appointed by GSCDL, the extra depth shall have to be filled up with concrete at the contractor's own cost to the requirements and satisfaction of the Project Manager/appropriate government authority appointed by GSCDL.

Re-Filling

After the sewer or other work has been laid and proved to be watertight, the trench or other excavation shall be refilled. Utmost care shall be taken in doing this, so that no damage shall be caused to the sewer and other permanent works. Filling in the trenches and up to 50cms. Above the crown of the sewer shall consist of the finest selected materials placed carefully and consolidated. After this has been laid, the trench and other excavation shall be refilled carefully in layers of 150mm with materials taken from the excavation, each layer each layer being watered and consolidated.

Contractor shall restore Settlement and Damages

The Contractor shall at his own cost make good promptly, during the whole period the works are in hand, any settlement that may occur in the surfaces or roads, berms, footpaths, gardens, open spaces, etc. whether public or private caused by his trenches or his other excavation and he shall be liable for any accidents caused thereby. He also shall, at his own expense and charges, repair and make good any damage done to the buildings and other properties.

Disposal of Surplus Earth

The contractor shall at his own cost dispose within the site or as directed all surplus excavated materials not required on the works.

Timbering

The contractor shall at all times support efficiently and effectively the sides of the trenches and other excavations by suitable timbering, piling, sheeting, etc. The trenches shall be timbered closely in loose or sandy strata and below the surface of the sub-soil table. All timbering, sheeting and piling with their walls and supports shall be of adequate dimensions and strength and fully braced and strutted so that there is no risk of collapse or subsidence of the walls of the trench. The Contractor shall be held accountable and responsible for the sufficiency of all timbering, bracing, sheeting and piling used for and for all damages to persons and property resulting from the improper quality, strength, placing, maintenance, or removing of the same.

Removal of Water

The Contractor shall at all times during the progress of work keep the trenches and excavations free from water which shall be disposed off by him in a manner as will neither cause injury to the public health nor to the public or private property not to the work completed or in progress nor to the surface of any roads or streets nor cause any interference with the use of the same.

Trench Width

The width of excavated trench shall be as per the table given below:

Width at bottom-Excavation up to:	Pipe Diameter	Pipe Diameter	Pipe Diameter
	Up to 100mm	Up to 150mm	Up to 300mm
900mm depth	450mm	450mm	600mm
900mm to 1500 mm depth	600mm	600mm	900mm
1500mm to 3000 mm depth	750mm	750mm	1100mm
3000mm to 5000 mm depth	900mm	1000mm	1300mm

Protection of Existing Services

All pipes, water mains, cables, etc. if any met in the course of excavation shall be carefully protected and supported.

Concreting

All pipes at shallow road crossings and made up ground shall be laid on a bed of 6" (150mm) concrete with one part of cement, four parts of sand and eight parts of stone metal of ¾" (20mm) down grade properly consolidated. Concrete shall be laid to the full width of the trench and also in haunches.

Construction across Roads

All works across the roads shall be carried out as per the directions of the Project manager/ appropriate government authority appointed by GSCDL.

Water Supply

- ccclxxxii. Work under this section consists of furnishing all labour, material, equipment and appliances necessary and required to completely install the water supply system as required by the drawings, specified hereafter.
- ccclxxxiii. Without restricting to the generality of the foregoing the water supply system shall include the following:
 - oooo) All water lines to different parts of building and making connection from source etc.
 - pppp) Pipe protection and painting.
 - qqqq) Providing hot water geysers/system and insulation of hot water pipe lines, wherever required.
 - rrrr) Control valves, masonry chambers and other appurtenances.
 - ssss) Connections to all plumbing fixtures, kitchen equipment, tanks and appliances.

tttt) Excavation and refilling of pipe trenches wherever necessary
General Requirements

- ccclxxxiv. All materials shall be new of the best quality conforming to specifications. All works executed shall be to the satisfaction of the Project Manager/appropriate government authority appointed by GSCDL.
- ccclxxxv. Pipes and fittings shall be fixed truly vertical, horizontal or in slopes as required in a neat workmanlike manner.
- ccclxxxvi. Short or long bends shall be used on all main pipelines as far as possible. Use of elbows shall be restricted for short connections.
- ccclxxxvii. As far as possible all bends shall be formed by means of a hydraulic pipe bending machine for pipes up to 65mm diameter.
- ccclxxxviii. Pipes shall be fixed in manner as to provide easy accessibility for repair and maintenance and shall not cause obstructions in shafts, passages etc.
- ccclxxxix. Pipes shall be securely fixed to walls and ceiling by suitable clamps at intervals specified.
- cccxc. Valves and other appurtenances shall be so located as to provide easy accessibility for operations, maintenance and repairs.

G.I. Pipes and Fittings

The pipes shall be of medium quality (Class B) galvanized iron, screwed socketed and shall conform to IS1239. All fittings shall be malleable iron galvanized fittings of approved best Indian make.

- cccxc. All pipes inside the buildings and where specified, outside the building shall be galvanized steel tubes conforming to IS 1239-1979 of class specified. When class is not specified they shall be medium class.
 - cccxcii. Fittings shall be malleable iron galvanized fittings, approved make. All fittings shall have manufactures trade mark stamped on it. Fittings for G.I pipes shall include bends, tees, reducers, nipples, unions, bushes. Fittings shall be as directed by Project Manager/appropriate government authority appointed by GSCDL or appropriate authority appointed by GSCDL.
 - cccxciii. Pipes and fittings shall be jointed with screwed fittings care shall be taken to remove burr from the end of the pipe after cutting by a round file. Genuine red lead with grummet and a few strands of fine hemp shall be applied.. Care shall be taken to avoid air pockets G.I. pipes inside toilets shall be fixed in wall chases well above the floor. No pipes shall be inside a sunken floor as far as possible. Pipes may be run under the ceiling or floors.
- Clamps

G.I. pipes in shafts and other locations shall be supported by M.S. clamps of design approved by the Project Manager/appropriate government authority appointed by GSCDL. Pipe in wall chases shall be anchored by iron hooks. Pipes at ceiling level shall be supported on structural clamps fabricated from M.S. structural as described in section II. Pipes in typical shafts shall be supported on slotted angles/ channels as specified elsewhere.

Unions

The Contractor shall provide adequate number of unions on all pipes to enable dismantling later. Unions shall be provided near each gunmetal valve, stop cocks, or check valves and on straight runs as necessary at appropriate locations.

Flanges

Flanged connections shall also be provided on all equipments connections as necessary and required or as directed by the Project Manager/appropriate government authority appointed by GSCDL. Flanges shall be of forged type and not casted. Connections shall be made by the correct number and size of the bolts and made with 3mm thick insertion rubber washer. Where hot water or steam connections are made insertion gasket shall be of 1.5 m thick compressed asbestos fibre gaskets approved by the Project Manager/appropriate government authority appointed by GSCDL. Bolts hole diameter. For flange shall conform to match the specifications for C.I. sluice valve to IS 780- 1984.

Trenches

All G.I. Pipes below ground level shall be laid in trenches shall have a minimum cover of 60 cm. Excavation for trenches shall be done as specified, but the width and depth of the trenches shall be as follows:

Table 10: Diameter wise Width & Depth of Trenches

Diameter of pipes	Width of Trenches	Depth of Trenches
15 mm to 50 mm	30 cm	75 cm
65 mm to 100mm	45 cm	100 cm

Where specified in the bill of quantities all G.I. pipes in trenches shall be protected with fine sand 15cm thick layer all-round before filling in the trenches.

Painting

All pipes above ground shall be painted with one coat of red lead and two coats of synthetic enamel paint of approved shade and quality. Pipe shall be painted to standard colour code. All pipes in chases and below floor shall be painted two or more coats of anti- corrosive bitumen paint.

Pipe Protection

Where specified in the Chapter of quantities all pipes in chase or below ground shall be protected against corrosion by applying two coats of bitumen paint, wrapping with polythene tape and finishing with one more coat of bitumen paint.

H.D.P.E. Threaded Pipes

- cccxciv. The H.D.P.E. pipe shall be a threaded type of GI standard i.e. having specifications equivalent of GI of IS 1239 medium class but confirming to IS 4984-78
- cccxcv. The H.D.P.E. pipe shall confirm to pressure rating of 10 kg/sq cm and shall only be used for internal cold water in the building.
- cccxcvi. All other specification for laying and jointing shall conform to BIS so that GI pipe including for fitting etc., except no pipe protection is required in this case as specified in para 9.a, 9.b and 10.

Gun Metal Valves

Valves 65mm diameter and below shall be heavy gunmetal full may valves are globe bulbs confirming to IS: 778-1971, 10kg/sq cm or 20 kg/cm square as specified in bill of quantities. Valves shall be attested at manufacturer's work and the same on it. All valves shall be approved by the Project Manager/appropriate government authority appointed by GSCDL before they are allowed to be used on work. However the final responsibility of the quality of material lies with the Contractor.

Sluice valves

A valves 80mm diameter and above shall be CI double flanged sluice walls and/ or as specified in bill of quantities. Sluice valves shall be cast iron double flanged, with rising spindle is sluice valve shall be provided with wheels for valves in exposed position and kept for underground valves. The Contractor shall provide suitable operating keys for sluice valves with cap tops.

Sluice valves shall be best quality confirming to IS: 780-1969 of class specified.

Butterfly valves

Butterfly valves shall be C.I. as per IS 13095-1991 and having C.I. body, epoxy power coated disc, nitrile rubber sheet and all other detail as per requirement. The valves shall be jointed with flanged joints. The specification of the flanges shall be as per I.S.-6392-1971.

Valve up to 150 mm diameter shall be either hand lever or cap operated and from 200mm diameter and above shall be gearbox operated.

Testing

- cccxcvii. All pipes, fittings and valves shall be tested by hydrostatic pressure of 7.5 kg/sq cm. Pressure shall be maintained for a period of at least 120 minutes without any drop in the pressure after fixing at site. A test register shall be maintained and all entries shall be signed and dated by the Contractors and the Project Manager/appropriate government authority appointed by GSCDL.
- cccxcviii. In addition to the sectional testing carried out during the construction, the Contractor shall test the entire installation after connections to the overhead tanks or pumping system or mains. He shall rectify all leakages and shall replace all defective materials in the system. Any damage done due to carelessness, open or burst pipes or failure of fittings, to the building, furniture and fixtures shall be made good by the Contractor.
- cccxcix. After commissioning of the water supply system, the Contractor shall test each valve by closing and opening it a number of times to observe if it is working efficiently. Valves, which do not effectively operate, shall be replaced by new ones and the same shall be tested as above.

Insulation

- cd. Magnesia Insulation
Hot water pipe fixed in case shall be insulated by wrapping 6mm thick asbestos dipped in 85% magnesia solution around the pipes and finished with a port of 1:3 cement plaster mixed with rapid hardening cement.

- cdi. External hot water pipes in shafts floors and trenches shall be insulated by 2 layers of 6mm thick insulation and then will be having finished smooth surface with 12mm thick cement plaster (two layers of 6mm thick or mix 1:2 Portland cement and fine sand).

Cast Iron Pipes s/s

- cdii. Where specified pipes 80mm id and above shall be S/S spun cast iron pipes' conforming to IS 1536-1967. Pipes shall be of maximum lengths available and suitable for moulded rubber joints.
- cdiii. Fittings shall be S/S cast iron conforming to IS 1538-1967.
- cdiv. Laying Pipes

uuuu) Pipes shall be laid out in open trenches with a minimum cover of 75 cm over the crown of the pipes. Width of the trench shall be nominal pipe diameter plus 45 cm with a minimum of 60 cm.

vvvv) Pipes may be laid on RCC slabs/rafts and shall be supported by bricks pillars at intervals not exceeding 2.4 m.

wwww) The socket of the pipes shall be laid facing the flow (the water should enter from socket end)

xxxx) Pipes should be kept thoroughly clean during the course of laying. Each end shall be blocked by a thick block of wood and wedged at the end of each day's work to prevent dirt and animals from entering the pipes.

Joints for pipes and between spun pipes and C.I. fittings, collars, etc. shall be made with moulded rubber and refined pig lead conforming to IS 27 2977 respectively. The spigot of the pipe of fittings shall be centered in the adjoining socket by caulking. Sufficient turns of tarred gaskin shall be caulked to leave required depth on the socket for lead.

After pouring the lead, it shall be solidly caulked with suitable tools and hammers. Depth and weight of lead shall be:

Table 11: Pipe Diameter wise Depth and Wight of Lead

Pipe diameter	Weight of lead/joint	Depth of lead
80 mm	1.8 kg	45 mm
100 mm	2.2 kg	45 mm
150 mm	3.4 kg	45 mm
200 mm	5.0 kg	50 mm
250 mm	6.1 kg	50 mm
300 mm	7.2 kg	55 mm

Rubber Joint

Joints between two pipes shall be made by premoulded rubber joints with suitable tackles in a manner recommended and approved by the manufacturer. No joints shall be covered until the lines are hydraulically tested.

Lead Caulked Joints

Joints between pipes and C.I. fittings shall be made with refined pig lead. The spigot of the pipe shall be centered in the adjoining socket by caulking sufficient turn of tarred gaskin, which will be caulked into the joint to leave a depth of 45 mm for pig lead. Molten pig lead shall then be poured into the joint in one pouring. The lead shall then be solidly with suitable tools and hammers.

The Contractor may use lead wool joints in wet trench conditions.

Anchor Blocks

Suitable anchor blocks shall be provided at all bends and tees to encounter the excessive thrust development due to water hammer.

Valves

cdv. Air Valves

yyyy) Air valves shall be provided in all high points in the system to prevent air locks.

zzzz) Air valves shall be of single acting heavy duty brass spring type.

cdvi. Scour Valves

Scour valves shall be provided at all low points in the system. Valves shall be gunmetal full way valves for sizes 50 mm diameter. And below and butterfly valves 65 mm diameter and above.

cdvii. Sluice Valve

aaaaa) Sluice valve shall be socket type or double flanged type confirming to IS 780.

bbbb) Joints for socket valves shall be lead caulked joints as specified above.

cccc) Joints for double flanged sluice valve shall be made with suitable tail/socket pieces on pipe line and flanges joints made with 3mm thick insertion rubber gasket with appropriate number of bolts, nuts, washers etc.

Fire Hydrants

Fire hydrant shall be cast iron stand post type with 63mm diameter instantaneous gunmetal outlets conforming to I.S. 908

Each fire hydrant shall be provided with an 80 mm cast iron sluice valve, duct foot bend and a suitable 63 mm diameter flanged cast iron pipe for correcting the installation height of the hydrant.

Valve chambers

The Contractor shall provide suitable brick masonry chambers in cement mortar 1:5 (1 cement: 5 coarse sand) on cement concrete foundations 150 mm thick 1:4:8 mix (1 cement: 4 fine sand: 8 graded stone aggregate 40 mm nominal size) 15 mm thick cement plaster of 1:4 (1 cement: 4 coarse sand) inside and outside finished with a floating coat at neat cement inside with casts iron surface box approved by fire brigade including excavation, back filling complete.

Valve chamber shall be of following size: For depth 90 cms – 60 x 60 cms

For depths upto 100 cms beyond–120x120 cms

Laying and Fixing

Where pipes have to be cut or re-threaded, ends shall be carefully filed out so that no obstruction to bore is offered. For internal work all pipes and fittings shall be fixed truly vertical and horizontal, either by means of standard pattern holder bat clamps keeping the pipes ½” (12mm) clear of the wall everywhere or concealed as directed. Pipes and fittings shall be laid in trenches for external works. The width of the trench shall be the minimum width required for working. The pipes laid underground shall be not less than 600mm from the finished ground level.

Painting

The exposed pipes shall be painted with two coats of enamel paint over a coat of primer of approved make.

Testing

Before any pipes are painted or covered, they shall be tested to a hydrostatic pressure of 1.5 times the working pressure. Pressure shall be maintained for at least eight hours without appreciable drop in pressure. In addition to the sectional testing of water supply pipes, the contractor shall test the whole of the installation to the entire satisfaction of the Project Manager/appropriate government authority appointed by GSCDL. He shall rectify any leakage, failure of fittings or valves.

- cdviii. All pipes, fitting and valves shall be tested by hydrostatic pressure of 7.5 kg/sq.cm. Pressure shall be maintained for a period of at least 120 minutes without any drop in the pressure after fixing at site. A test register shall be maintained and all entries shall be signed and dated by the Contractors and the Project Manager/appropriate government authority appointed by GSCDL.
- cdix. In addition to the sectional testing carried out during the construction, the Contractor shall test the entire installation after connections to the overhead tanks or pumping system or mains. He shall rectify all leakages and shall replace all defective materials in the system. Any damage done due to carelessness, open or burst pipes or failure of fittings to the building, furniture and fixtures shall be made good.
- cdx. After commissioning of the water supply system, the Contractor shall test each valve by closing and opening it a number of times to observe if it is working effectively. New ones shall replace valves, which do not effectively operate, and the same shall be tested as above.

Disinfective

- cdxi. After completion of the work, the Contractor shall flush clean the entire system with the city's filtered water after connection has been made.
- cdxii. After the first flushing, add commercial bleaching powder or achieve a dosage of 2 to 3 mg/l of water in the system added and flushed. This operation should be performed twice

to ensure that the system is fully disinfected and usable.

Pre-commissioning

- dddd) Ensure that all pipes are free from debris and obstructions.
 - eeee) Check all valves and fire hydrant for effective opening and closing action. Defects should be rectified or valves replaced.
 - ffff) Ensure that all connections to branches have been made.
- cdxiii. Ensure that mains have been connected to the respective pumps, underground and overhead tanks.
- cdxiv. Water supply should be available at main underground tank. (c) All main line valves should be closed.

Commissioning

- ggggg) Fill tank with water. Add 1 kg fresh bleaching powder after making a solution to be added near inlet.
- hhhhh) Start water supply pumps and allow water to fill main underground tank. Water will first fill the fire tank and then overflow to the domestic tanks.
- iiii) After filling overhead reservoirs drain the same to its one fourth capacity through tank scour valve (this is to ensure removal of all mud, debris etc. from the tank).
- jjjjj) Fill overhead tank to full.
- kkkkk) Release waste in the main lines by opening valves in each circuit. Drain out water in the system through system scour valve or fire hydrant in lower regions. Ensure clean water is now coming out of the system.
- lllll) Open valves for individual cluster. Observe for leakages or mal function, check pressure and flow at end of line by opening hydrants etc. Remove and rectify defects notice.
- mmmmm) Check all fire hydrants for proper operation by opening each valve and allowing water to flow for few minutes. Also check for effective closure of valve.
- nnnnn) The entire water supply system should be disinfected with bleaching powder and system flush cleaned.
- oooo) Send four samples of water drawn from four extreme locations for testing for bacteriological in sterilized bottles obtained from the concerned laboratory.
(Laboratory personal may collect the samples themselves).
- ppppp) Responsibility for various activities in pre commissioning and commissioning procedures will rest with the Contractor.

Mode of Measurement

Above ground GI pipes shall be measured along the centerline of the pipes and fittings. The quoted rate for respective item shall be per RMT and shall include the following:

- cdxv. Cost of respective pipes and specials.

- cdxvi. Labor for laying, fixing and jointing with necessary clamps.
- cdxvii. Cutting holes and chases in walls, floors, etc. and making good the same.
- cdxviii. All supporting arrangements, brackets, etc.
- cdxix. Testing and making good the defects, if any. GI. Pipes laid underground shall be measured as stated elsewhere in the specification.

Water Fittings (Taps, Stop Cocks, etc.)

All water fittings shall be of approved quality and design and shall generally comply with latest I.S. specifications. The fittings and joints shall be tested for 4kg/sq.cm. Defective fittings and the joints shall be repaired or redone/replaced as directed.

Mode of Measurement

These items shall be measured in number unless included as part of other items viz. Washbasins, inlets to flush valve etc. Cost of fittings shall include:

- cdxx. Cost of material
- cdxxi. Cost of fixing accessories like bolts, nuts, washers.

Valves and Pressure Gauges

The pressure gauges shall have not less than 115mm dia, 10mm BSP full threads brass body siphon and gauge cock of 10mm size. Dial gauges shall be adequate for the pressures encountered and specified (0 -15Kg/cm square).

Valves shall be provided on branch pipe connection to mains and at connection to equipment where indicated. All valves are to be located for easy access and are to be full bore of pipe connected together. All valves shall be supported wherever necessary. Valves shall be ball valve type with G.M. body from 15 mm dia to 32 mm dia and C.I body Butterfly valve from 40 mm dia and above.

Bib Cock and Stop Cock

Bib cock (stock cock) is a draw off tap with a horizontal inlet and free outlet and stop cock (stop tap) is a valve with a suitable means of connections for insertion in a pipeline for controlling or stopping the flow. They shall be of specified size and shall be of screw down type. The closing device should work by means of a disc carrying a renewable non-metallic washer shutting against water pressure on the seating at right angles to the axis of the threaded spindle operating it. The handle shall be either crutch or butterfly type securely seated pattern. The cocks (taps) shall open in anti-clockwise direction.

The Bib cocks and stopcocks shall be polished bright. The minimum finished weights or bib tap (cock) and stop tap (cock) as given in the IS specification are reproduced below:

Table 12: Minimum finished weights or bib tap (cock) and stop tap (cock)

Size mm	Minimum finished weight	
	Bib tap kg.	Stop tap kg.
8	0 – 25	0 – 25
10	0 – 30	0 – 35

Size mm	Minimum finished weight	
	Bib tap kg.	Stop tap kg.
15	0 – 40	0 – 40
20	0 – 75	0 – 75

Ball Valve

The ball valve shall be of high pressure type shall be of sizes as specified.

The normal size of a ball valve shall be that corresponding to the size of the pipe to which it is fixed. The ball valve shall be of brass or gunmetal as specified, and the float of copper sheet. The minimum thickness of copper sheet used for making the float shall be 0.45mm for float exceeding 115mmdia. Plastic floats may also be used if specified. Body of the ball valve when assembled in working conditions with the float immersed to not more than half of its volume shall remain closed against a test pressure of 3.5kg/sqcm.

The ball valve shall generally conform to IS specification No.1703: 1977. The weight of ball cock and the size of the ball cock shall be as per IS specification.

Foot Valves

Provide cast iron body with brass disc and strainer of approved quality, wherever shown with flanged ends /screwed ends as per Bill of quantities / Drawings.

Pressure Reducing Valves

Pressure reducing valves shall be of approved make bronze pilot operated spring loaded valves for reducing pressure from 7.0 kg/cm² to 2.0 kg/cm² suitable for specified dia of pipe as mentioned in the detailed Bill of quantities / Drawings.

“Y” STRAINERS

“Y” Strainers shall be of C.I body with brass strainer of approved quality and design with flanged ends and necessary neoprene rubber gaskets, nuts and bolts.

Mode of Measurements

Valves shall be measured in number only and the cost shall include:

- cdxxii. Cost of valve and jointing materials.
- cdxxiii. Fixing and jointing with necessary bolts, nuts, rubber inserting,
- cdxxiv. Testing and making good the defects if any.

Appurtenances

The other appurtenances of pipe line are mentioned below:

- cdxxv. Scour Valves:
These are placed at the bottom of all depressions for emptying the main or letting out the sediment.
- cdxxvi. Reflux valves:

These are fixed so as to open in the direction of flow but automatically close if the water flows back. They are used to diminish the damage done by the escape of water due to a burst or prevent damage to impellers of pumps.

PVC Pipes and Fittings

Material

PVC pipes and fittings for soil, waste and rain water pipes (SWR grade) shall be heavy quality conforming to IS 13592, or as mentioned in BOQ, fittings to BS 4515 and rubber rings to IS 5382.

Laying

The PVC pipe shall be laid under the floors in the slab sunk or on walls either buried or exposed as the case may be, as shown on the drawings. The minimum thickness of fittings shall be 3.2mm. The fittings shall be of injection molded with rubber ring socket. The pipes and fittings shall be capable of withstanding sunrays.

Jointing

The jointing of the pipes to the fittings shall be done as per the manufacturer's instructions/recommendation. The rubber ring socket fittings and pipes shall be jointed as follows:

Clean the outside of the pipe spigot-end and the inside of the sealing groove of the fitting. Apply the lubricant uniformly to the spigot end, sealing ring and pass the spigot end into the socket containing sealing ring until fully home. Mark the position of the socket edge with pencil or felt-pen on the pipe, then withdraw the pipe from the socket by approximately 10mm to make the pipe fully fitted to the fitting. The horizontal pipes on the wall shall be fixed with pipe clips supplied from the same manufacturer. The spacing of the clips shall be at the intervals of 1.5m to 2 m depending on the availability of the supporting arrangements.

Testing

PVC pipes and fittings shall be tested for three meters of water head. The opening of the pipes shall be sealed for the section to be tested. The water pressure shall be maintained for maximum of one hour. The Project manager/ appropriate government authority appointed by GSCDL shall examine carefully all the joints for leaking.

Stoneware (SW) Pipes and Fittings

Material

Stoneware pipes and fittings shall comply with IS 651-1980 in every respect and all stoneware pipes, bends, etc. shall be of the best salt glazed variety, glazed inside as well as outside, hard smooth, even textured, free from fire cracks, air blows and blisters. The pipe shall be truly circular in cross section, perfectly straight and of standard nominal diameter, length and depth of socket.

Laying

The pipes shall be carefully laid to the levels and gradients shown in the plans sections by making use of sight rails and bonding rods with socket up the gradient.

Jointing

Hemp rope soaked in neat cement wash shall be passed round the joint and inserted in it by means of caulking tool. More skins of yarn shall be added and well rammed home. Cement mortar with one part of cement and one part of sand with minimum water content, but on no account soft or sloppy, shall be carefully inserted by hand into the joint and more cement mortar added until the space of the joint has been shall be then finished off neatly outside the socket at angle of 45deg.

Curing

The joint shall be cured at least for 48 hours before backfilling.

Testing

All lengths of the sewer and drain shall be fully tested for water tightness by means of water pressure maintained for not less than 30 minutes. Testing shall be carried out from manhole to manhole. All pipes shall be subjected to test pressure of at least 1.5 meters head of water at the highest point of the section under test. The Pipes shall be preferably plugged with standard drain plugs (with rubber rings) on both ends. The upper end shall however be connected to a pipe for filling with water and getting the required head. The contractor shall also carry out the smoke test for the sewers inside the buildings.

Mode of Measurement

Excavation

The width of excavation shall be in accordance with the table in clause 3.9 any excavation done within the building shall not be measured and paid for.

Stoneware Pipes

Stoneware Pipes shall be measured along the centerline of the pipeline including the specials in running meter(Rmt) length between:

- cdxxvii. Chambers: shall be measured along the centerline of the chamber to inside of another chamber.
- cdxxviii. Gully trap and chamber: Shall be recorded between socket pipe near gully trap and inside of chamber. The quoted rate shall include the following:
 - qqqq) The cost of pipes, special and other jointing materials.
 - rrrr) Labor for Installing, Jointing and curing.
 - ssss) Testing and making good the defects, in any.

PVC Pipes

Pipes shall be measured along the centerline of the pipe including all specials in Rmt. The quoted rate for respective items shall include the following:

- cdxxix. Cost of respective pipes and special and jointing materials.
- cdxxx. Labor for Laying, fixing and jointing with necessary clamps, brackets, screws, etc. and curing.
- cdxxxi. Making good all damages to the parts of the building to suit the surroundings.
- cdxxxii. Testing and making good the defects, if any.

Sewerage/Drainage System (External)

- cdxxxiii. Work under the section shall consist of furnishing all labour materials equipment and appliances necessary and required to completely finish sewerage / drainage system as required by the proposal approved and specified hereinafter.
- cdxxxiv. Without restricting to the generality of the foregoing the sewerage / drainage system shall include

tttt) Internal / External sewer line.

uuuuu) Excavation including refilling etc.

vvvvv) Construction of collection chambers manholes and drop connections.

wwwww) Construction of grease trap etc.

xxxxx) Construction of external sewer line.

yyyyy) Storm water drainage and sewage disposal.

General Requirements

- cdxxxv. All materials shall be new of the best quality conforming to specifications and subject to the approval of the Project Manager/appropriate government authority appointed by GSCDL.
- cdxxxvi. Drainage lines shall be laid to the required gradients and profiles
- cdxxxvii. All drainage work shall be done in accordance with the local municipal byelaws
- cdxxxviii. Contractor shall obtain necessary approval and permission for the drainage system from the municipal or any other Government Agency.
- cdxxxix. Location of all manholes, catch basins, etc. shall be confirmed by the Project Manager/appropriate government authority appointed by GSCDL before the actual execution of work at site.
- cdxli. All works shall be executed as directed by the Project Manager/appropriate government authority appointed by GSCDL.

Alignments and grade

The sewers and storm water lines shall be laid to alignment and gradient shown on the drawings but subject to such modifications as shall be ordered by the Project Manager/appropriate government authority appointed by GSCDL from time to time to meet the requirements of the works. No deviations from the lines depths of cutting or gradients of sewer shown on the plans and sectors shall be permitted except to the direction in writing of the Project Manager/appropriate government authority appointed by GSCDL.

Excavation

- cdxli. The excavation for sewers and stone water drains shall be in open cutting unless the permission of the Project Manager/appropriate government authority appointed by GSCDL for the ground to be tunneled is obtained in writing. Where sewers have to be constructed along narrow passages, the Project Manager/appropriate government

authority appointed by GSCDL may order the excavation to be made partly in tunnel and in such cases the excavated soil be brought back later on for refilling the trenches or tunnel.

cdxlii. Opening Out Trenches

In excavation the trenches, etc., the soiling roads, metaling, pavement, kerbing etc., and turf shall be placed on one side and preserved for reinforcement when the trenches or other excavation shall be filled up. Before any road metal is replaced, it shall be carefully shifted. The surface of all trenches and holes shall be restored and maintained to the satisfaction of Authority/Project Manager/appropriate government authority appointed by GSCDL. the Project Manager/appropriate government authority appointed by GSCDL and of the owners of the roads or other property traversed and the Contractor shall not cut out or break down any live fence or trees in the line of the proposed works but shall tunnel under them, unless the Project Manager/appropriate government authority appointed by GSCDL shall order to the contrary.

cdxlili. Obstruction of Roads

The Contractor shall not occupy or obstruct by his operation more than one half of the width of any road or street and if insufficient space shall then be left for public and private transit, he shall remove the materials excavated and bring them back again when the trench is required to be refilled. The Contractor shall obtain the consent of the Project Manager/appropriate government authority appointed by GSCDL in writing before closing any road to vehicular traffic and the foot walks must be clear at all times.

cdxliv. Removal of Filth

All night soil, filth or any other offensive matter is met with during the execution of works, immediately after it is taken out of any trench, sewer or cess pool, shall not be deposited on the surface of any street or where it is likely to be a nuisance or passed into any sewer or drain but shall be at once put into the carts and removed to suitable place to be provided by the Contractor.

cdxlv. Excavation to be taken to Proper Depth

The trenches shall be excavated to such a depth that the sewer shall rest on concrete described by the several clauses relating thereto and so that the inverts may be at the levels given the sections. In bad ground, the Project Manager/appropriate government authority appointed by GSCDL may order the Contractor to excavate to a greater depth than that shown on the drawings and to fill up the excavation to the level of the sewer with concrete, broken stone, gravel or other materials.

cdxlvi. Refilling

After the sewer or other work has been laid and proved to be water tight, the trench or other excavations shall be refilled. Utmost care shall be taken in doing this, so that no damage shall be caused to the sewer and other permanent work. The filling in the haunches and upto 75 cm above the crown of the sewer shall consist of the finest selected materials place carefully in 15 cm. Layers and flooded and consolidated. After this has laid the trench and other excavation shall be refilled carefully in 15 cm layers with materials taken from the excavation, each layer being watered to assist in the consolidation unless the Project Manager/appropriate government authority appointed by GSCDL shall otherwise direct.

- cdxlvii. The Contractor to restore settlement and damages
The Contractor shall at his own costs and charges, make good promptly during the whole period, the work are in hand, any settlement that may occur in the surfaces of roads, berms, footpaths, gardens, open spaces, etc., whether public or private caused by his trenches or by his other excavations and he shall be liable for any accidents caused thereby, he shall also, at his own expenses and charges repair and make good any damage done to buildings and other property.
- cdxlviii. Disposal of Surplus Soil
The Contractor shall at his own costs and charges provide places for disposal of all surplus materials not required to be used on the works. As each trenches refilled the surplus soil shall be immediately removed, the surface properly restored and roadways and sides left clear.
- cdxlix. Timbering of sewer and trenches
The Contractor shall at all times support efficiently and effectively the sides of the sewer trenches and other excavation by suitable timbering, piling and sheeting and they shall be closed, timbered in loose or sandy strata and below the surface of the sub-soil water level.
All timbering sheeting and piling with their walling supports shall be adequate dimensions and strength and fully braced and strutted so that no risk of collapse or subsidence of the walls of the trench shall take place.
The Contractor shall be held responsible and will be accountable for the sufficiency of all timbering, bracing, sheeting and piling used as also for, all damage to persons and property resulting from improper quality, strength, placing maintaining or removing of the same.
- cdl. Shoring of building
The Contractor shall shore up all buildings, walls and other structures, the stability of which is liable to be endangered by the execution of the work and shall be fully responsible for all damages to persons of property resulting from any accident.
- cdli. Removal of water from sewer, trench etc.
zzzzz) The Contractor shall at all times during the progress of the work keep the trenches and excavations free from water which shall be disposed of by him in a manner as will neither cause injury to the public health nor to the public or private property nor to the work completed or in progress nor to the surface of any roads or streets, nor cause any interference with the use of the same by the public.
aaaaaa) If any excavation carried out at any point or points to a greater width than the specified cross section of the sewer with its envelope, the full width of the trench shall be filled with concrete by the Contractor.
- cdlii. Width of Trench
The Project Manager/appropriate government authority appointed by GSCDL shall have power by giving an order in writing to the Contractor to increase the maximum width for excavation in trenches for various classes of sewer, man holes and other works in certain lengths to be specifically laid down by him, where on account of bad ground or other

unusual conditions, he considers that such increased widths are necessary in view of the site conditions.

Salt Glazed Stoneware Pipes

- cdliii. Stoneware pipes shall be first class quality salt glazed and free from rough texture inside and outside and straight. All pipes shall have the manufacturer name marked on it and shall comply to IS 651-1971. Approved makes [PERFECT or BURN].
- cdliv. Laying and jointing of stone ware salt glazed pipes

bbbbb) Pipes are liable to be damaged in transit and not withstanding tests that may have been made before dispatch each pipe shall be examined carefully on arrival at site. Each pipe shall be rung with a wooden hammer or mallet and those that do not ring true and clear shall be rejected. Sound pipes shall be carefully stacked to prevent damage. All defective pipes should be segregated, marked in a conspicuous manner and their use in the works prevented.

cccccc) The pipes shall be laid with sockets leading up hill and should rest on solid and even foundations for the full length of the barrel. Socket holes shall be formed in the foundation sufficiently deep to allow the pipe jointer room to work right round the pipe and as short as practicable to admit the socket and allow the joint to be made.

dddddd) Where pipes are not bedded on concrete the trench bottom shall be left slightly high and carefully bottomed up as pipe laying proceeds so that the pipe barrels rest on firm ground, if excavation has been carried too low it shall be made up with cement concrete (1:5:10) mix at the Contractor's expenses and charges.

eeeeee) If the bottom of the trench consists of rock or very hard ground that cannot be easily excavated to a smooth surface, the pipes shall be laid on cement concrete bed to ensure even bearing.

- cdlv. Jointing of pipes

Tarred gasket shall first be wrapped round the spigot of each pipe and the spigot shall then be placed in to the socket of the pipe previously laid, the pipe then shall be adjusted and fixed in its correct position and the gasket caulked tightly home so as to fill not more than one quarter of the total length to the socket.

The remainder of the socket shall be filled with a stiff mix of cement mortar (1 cement: 1 clear sharp washed sand). When the socket is filled, a fillet should be formed round the joint with a trowel forming an angle of 45 degrees with the barrel of the pipe. The mortar shall be mixed as needed for immediate use and no mortar shall be beaten up & used after it has begun to set.

After the joint has been made and extraneous materials shall be removed from inside the joint with a suitable scraper —badger. The newly made joints shall be protected until set from the sun drying winds, rain or dust. Sacking or other materials, which can be kept damp, shall be used. The joint shall be exposed and spaces left all-round the pipes for inspection by the Project Manager/appropriate government authority appointed by

GSCDL. The inside of the sewer must be left absolutely clear in bore and free round cement mortar or other obstructions throughout its entire length, and shall efficiently drain and discharge.

cdlvi. Testing

All lengths of the sewer and drain shall be fully tested for water tightness by means of water pressure maintained for not less than 30 minutes. Testing shall be carried out from manhole to manhole. All pipes shall be subjected to a test pressure of at least, 1.5 meter head of water at the highest point. Pressure shall, however, not exceed 1.5 meter head at any point. The pipes shall be plugged preferably with standard design plugs with rubber plugs on both ends. The upper end shall, however, be connected to a pipe for filling with water and getting the required head.

A test register shall be maintained which shall be signed and dated by Contractor and Project Manager/appropriate government authority appointed by GSCDL.

Gully Traps

cdlvii. Gully traps shall be of the same quality as described for stoneware pipes.

cdlviii. Gully traps shall be fixed in cement concrete 1:4:8 mix and brick masonry. Chamber 30x30cm C.I. sealed cover and frame weighing not less than 7.3 Kg to be constructed as per standard drawings. Where necessary, sealed cover shall be replaced with C.I. grating of the same size (1 Cement: 4 Coarse: 8 stone aggregate 40 mm nominal size).

Reinforced Cement Concrete Pipes

cdlix. All underground storm water drainage pipes and sewer lines where specified (other than those specified cast iron) shall be centrifugally spun RCC pipes of specified class. Pipes shall be true and straight with uniform bore throughout. Cracked, wrapped pipes shall not be used on the work. All pipes shall be tested by the manufacturer and the Contractor shall produce, when directed, a certificate to the effect from the manufacturer.

cdlx. Laying

R.C.C. spun pipes shall be laid on cement concrete bed or cradle as specified and shown on the detailed drawings. The cradle may be precast and sufficiently cured to prevent cracks and breakage in handling. The invert of the cradles shall be left 12mm below the invert level of the pipe and properly placed on the solid to prevent any disturbance. The pipe shall then be placed on the bed concrete of cradles and set for the line gradient by means of sight rails and boning rods, etc. Cradles or concrete bed may be omitted, if directed by the Project Manager/appropriate government authority appointed by GSCDL.

cdlxi. Jointing

After setting out the pipes the collar shall be centered over the joint and filled in with tarred gaskin, so that sufficient space is left on either side of the collar to receive the mortar. The space shall then be filled with cement mortar (1 cement: 2 fine sand) and caulked by means of proper tools. All joints shall be finished at an angle of 45 degrees to the longitudinal axis of the pipe on both sides of the collars neatly.

cdlxii. Testing

All pipes shall be tested to a hydraulic test of 1.5 m head for at least 30 minutes at the highest point in the section under test. Test shall also be carried out similar to those for

stoneware pipes given in this chapter. The Contractor shall also carry out the smoke test. A test register shall be maintained which shall be signed and dated by Contractor/ Project Manager/appropriate government authority appointed by GSCDL.

Cast Iron Pipes for Drainage

- cdlxiii. All drainage lines passing under building, floors and roads with heavy traffic, in exposed position above ground e.g. service floor and basement ceiling shall be cast iron pipes.
- cdlxiv. Cast iron pipes shall be centrifugally spun cast iron pipes conforming to IS 1536-1967. Quality certificate shall be furnished.
- cdlxv. Fittings and Inspection Chambers
Fittings used for C.I. drainage pipes shall conform to IS 1538-1967. Wherever, possible junction from branch pipes shall be made by a Y tee. Cleanout plugs shall be provided on head of each drain and at locations indicated on plans or as directed by Project Manager/appropriate government authority appointed by GSCDL. Cleanout plugs shall be of size matching the full bore of the pipe. Plugs shall be made from G.I. coupling caulked into the socket of the pipe for fitting. The end of the provided with a brass screwed plugs with suitable key for opening.
- cdlxvi. Laying

fffff) All cast iron pipes and fittings shall be joined with best quality soft pig lead (conforming to IS 279-1977) which shall be free from impurities.

ggggg) The spigot of pipe or fittings shall be centered in the adjoining socket by caulking.

Sufficient turns of tarred gaskin will be given to leave unfilled the required depth of socket for depth 45 mm when the gaskin has been caulked tightly home jointing ring shall be placed round the barrel and against the face of the socket. Molten pig lead shall then be poured to fill the remainder of the socket. This shall be done in one pouring. The lead shall then be solidly caulked with suitable tools and hammers weighing not less than 2 kg. For lead wool joints the socket shall be caulked with tarred gaskin as explained above. The lead wool shall be inserted into the sockets and tightly caulked home by gaskin with suitable tools and hammers of not less than 2 kg.

hhhhh) For the lead wool joints the socket shall be caulked with tarred gaskin, as explained above. The lead wool shall be inserted into the sockets and tightly caulked home by gaskin with suitable tools and hammers of not less than 2kg weight until joint is filled.

CI Pipe Fitting (Rain water pipe):

iiiiii) The pipes shall be manufactured by closed grain CI and shall satisfy IS 1230 / I.S. 2527 in all respects. The number of pipes and the diameter shall be worked out on the basis of 1" Sq. of CSA for every 60 specifications No. 3.54. The minimum weight v/s nominal diameter shall be as under:

Table 13: Minimum Weight and Nominal Diameter

Nominal (mm)	Weight/m	Length (m)	Size of socket	Thick (mm)
90	14	1.8	114.4	3.2
50	26	1.8	166.2	3.6

cdlxvii. Testing

All cast iron pipes for drainage shall be tested to a hydraulic test of 3- meter head. Test for straightness shall be same as for stoneware pipe given in point 5.d A test register shall be maintained which shall be signed and dated by Contractor and Project Manager/appropriate government authority appointed by GSCDL.

Manhole and Chambers

This Shall be same as described in below Manhole section

Drop Connection

This Shall be same as described in below Drop Connection section

Sewer Appurtenance (Internal)

cdlxviii. Work under this section shall consist of furnishing all labour, materials, equipment and appliances necessary and required to completely install all soil, waste, vent and rainwater pipes.

cdlxix. Without restriction to the generally of the foregoing, the soil, waste, vent and rainwater pipes system shall include the followings:

jjjjj) Vertical and Horizontal soil, waste and vent pipes, rainwater pipes & fittings, joint clamps and connections to the fixtures

kkkkk) Connections of pipes of gully traps and manholes etc.

lllll) Floor and urinal traps, cleanout plugs, inlet fittings and rainwater head as specified.

mmmmm) Waste pipes connections from all fixtures e.g. wash basins, sinks, urinals, and kitchen equipments.

nnnnn) Testing of all pipes.

General Requirements

cdlxx. All materials shall be new of the best quality conforming to specifications and subject to the approval of the Project Manager/appropriate government authority appointed by GSCDL.

cdlxxi. Pipes and fittings shall be fixed truly vertical, horizontal or in slopes as required in a neat workman like manner.

cdlxxii. Pipes shall be fixed in a manner as to provide easy accessibility for repair and maintenance and shall not cause obstruction in shafts, passages etc.

cdlxxiii. Pipes shall be securely fixed to walls and ceiling by suitable clamps at intervals specified.

cdlxxiv. Access doors for fitting and cleaning shall be so located that they are easily accessible for repair and maintenance.

cdlxxv. All works shall be executed as directed by the Project Manager/appropriate government authority appointed by GSCDL.

Cast iron pipes and fittings Cast Iron Pipes

- i. Soil, waste, vent anti-symphonize and rainwater pipe shall be cast iron pipes/UPVC. All pipes shall be straight and smooth and inside free from irregular bore, blow holes cracks and other manufacturing defects. Pipes shall be centrifugally spun iron soil pipes conforming to IS: 3989-1970, or sand cast IS: 1729-1967.
- ii. Standard weight, dimensions and pig lead required for joints shall be as follows: For pipes conforming to IS: 3989- 1970 (centrifugally spun soil pipes).

Table 14: Pipe Joints Sizes and Weights

Nominal (inch)	Diameter (mm)	Thickness (mm)	Overall Weight 6' length or 1.83m (kg)	Internal diameter of socket (mm)	Depth of lead (mm)
2	50	3.5	8.5	73	25
3	75	3.5	12.7	99	25
4	100	4.0	19.2	126	25
6	150	5.0	35.5	178	38
For conforming to IS 1729-1967 (sand cast iron soil pipes and fittings)					
2	50	5	11.41	76	25
3	75	5	16.52	101	25
4	100	5	21.67	129	25
6	150	5	31.91	181	

- iii. Tolerance
Acceptable tolerance for pipes to I.S. 3989 and ISI 1729 shall be as follows:
 - Wall thickness -15%
 - Length +20mm
 - Weight -10%

Fittings

- cdlxxvi. Fittings shall conform to the same Indian Standard as for matching Contractor use pipes and fittings of matching specifications.
- cdlxxvii. Fittings shall be of the required degree of curvature with or without access doors.
- cdlxxviii. Access door shall be made up with 3mm thick insertion rubber washer and white lead. The bolts shall be lubricated with grease or white lead for easy removal later. The fixing shall be air and water tight.

Fixing

- cdlxxix. All vertical pipes shall be fixed by M.S. clamps truly vertical. Branch pipes shall be connected to the stack at the same angle as that of the fittings. No collars shall be used on vertical stacks. Each stack shall be terminated at top with a cowl. (Terminal Guard).
- cdlxxx. Horizontal pipes running along ceiling shall be fixed on structural adjustable clamps of special design shown on the drawings or as directed. Horizontal pipes shall be laid to

uniform slope and the clamps adjusted to the proper levels so that the pipes fully rest on them.

cdlxxxii. The Contractor shall provide all sleeves, openings, hangers, and inserts during the construction. All damages shall be made good to restore the surface.

Cast iron pipes for drainage

cdlxxxiii. All drainage lines passing under building, floors and roads, in exposed position above ground or at basement ceiling level shall be C.I.L.A pipes position of such pipes shall be generally shown either on ground level drawing or ceiling of basement.

cdlxxxiv. Cast iron pipes shall be centrifugally spun iron pipes conforming to I.S. 1536-1967. Quality certificates shall be furnished.

cdlxxxv. Fittings and Inspection Chambers:-

cdlxxxvi. Fittings used for C.I. drainage pipe shall conform to ISI 1538-1967. Junction from branch pipes shall be made by Y, T.

cdlxxxvii. The Contractor shall provide cast iron inspection chamber at all junction. Inspection chamber shall be specially cast with inlet, outlet and branches or appropriate and required sizes.

cdlxxxviii. Cleanout plugs shall be provided on head of each drain. Cleanout plugs shall be of size matching the full bore of the pipe. Plugs shall be made out with G.I. coupling caulked into the socket of the pipe or fittings. The end shall be provided with a brass screwed plug with suitable key for opening.

Laying

cdlxxxviii. All cast iron pipes and fittings shall be joined with best quality soft pig lead, which shall be free from impurities. In wet trenches joints shall be made from lead wool. Nothing extra shall be paid for lead wool joints. Depth of the pig lead and weight for joints shall be as given in this section above.

ooooo) The spigot of pipe fittings shall be centered in the adjoining socket by caulking.

Sufficiently turns of tarred gaskin will be given to leave unfilled depth of socket for depth of 45mm when the gaskin has been caulked tightly barrel and against the face of the socket. Molten pig lead shall then be poured to fill the remainder of the socket. The lead shall then be solidly caulked with suitable tools and hammer weighting not.

ppppp) For lead wool joints the socket shall be caulked with tarred gaskin, as explained above. The lead wool shall be inserted into the sockets and tightly caulked home skein with suitable tools and hammer of not less than 2 kg weight until joint is filled.

Testing: All cast iron pipes for drainage shall be tested to a hydraulic test of 3- meter head. Test for straightness shall be same as for stoneware pipe. A test register shall be maintained which shall be signed and dated by the Contractor, and representative of the Project Manager/appropriate government authority appointed by GSCDL.

Clamps

- cdlxxxix. M.S. clamps shall be of standard design and fabricated from M.S. flat 40x3mm thick. They shall be painted with two coats of black bitumen paint before fixing.
- cdxc. Where M.S. clamps are to be fixed on RCC columns or slotted angles, walls or beam they shall be fixed with 40x3mm flat iron –Ull type clamps with anchor fasteners of approved design or 6mm nuts and bolts.
- cdxc. Structural clamps shall be fabricated from M.S. structural members e.g. rods, angles, channels flats. The Contractor shall provide all nuts bolts, welding material and paint the clamps with one coat of red oxide and two or more coats of black enamel paint. Wooden saddles, where required shall be provided free of cost.
- cdxcii. Slotted angle/channel supports on walls shall be provided. Angles/channels shall be fixed to brick walls with bolts embedded in cement concrete blocks and to RCC walls with suitable anchor fasteners. The spacing of support bolts horizontally shall not exceed 1m.
- cdxciii. Wherever M.S. clamps are required to be anchored directly to brick walls, concrete slabs, beams of columns, nothing extra shall be payable for clamping arrangement and making good with cement concrete 1:2:4 (1 cement: 2 coarse sand: 4 mm stone aggregate 20mm nominal size).

Traps

- cdxciv. Nahni Traps or Floor Traps
Nahni Traps or floor traps shall be cast iron, deep seal with an effective seal of 50mm. The trap and waste pipes shall be set in cement concrete blocks firmly supported on the structural floor. The blocks shall be in 1:2:4 mix (1 cement:2 coarse sand:4 stone aggregate 20 mm nominal size) and extended to 40 mm below finished floor level. The Contractor shall provide all necessary shuttering and centering for the blocks. Size of the block shall be 30x30cms of the required depth.
- cdxcv. Urinal Traps
Urinal Traps shall be cast iron P or S trap with or without vent and set in cement concrete blocks specified above without extra charge. Vitreous china channel with Openable cover shall be provided under the urinals.
- cdxcvi. Floor Trap inlet
Bathroom traps and connections shall ensure free and silent flow of discharging water. Where specified, the Contractor shall provide a special type cast iron inlet hopper without or with one, two or three inlet sockets to receive the waste pipes. Joint between waste and hopper inlet socket shall be lead caulked joint. Hopper shall be connected to a C.I. P. or S. trap with at least 50mm seal (Hopper and traps shall be paid for separately) floor trap inlet hoppers and the trap shall be set in cement concrete blocks as specified above without extra charge.
- cdxcvii. C.P. /Stainless Steel Gratings
Floor and urinal traps shall be provided with 100, 150 mm square or round C.P. / Stainless steel grating with frame of approval design and shape. Minimum thickness shall be 4-5 mm or as specified in the bill of quantities.

Jointing

cdxcviii. Soil waste vent and rainwater pipes shall be jointed with refined pig lead conforming to IS 27-1977. A sufficient skein or jute rope shall be caulked to leave a minimum space for the pig lead as given in Sikkim PWD Specifications /CPWD Specifications to pour in. After pouring the lead shall be caulked in the joint with request caulking tool and hammer. All surplus lead shall be cut and joint left 460 with rim of the socket neatly.

cdxcix. Cleanout Plugs

The Contractor shall provide cast brass cleanout plugs as required cleanout plugs shall be threaded and provided with keyholes for opening. Cleanout plugs shall be fixed to the pipe by a G.I. socket and lead caulked joint.

Waste Pipe from Appliances

- d. Waste pipe from appliances e.g. washbasins, sinks, urinals, bathtubs, water coolers shall be of galvanized steel, lead or PVC.
- di. All pipes shall be fixed in gradient towards the outfalls of drains. Pipe inside a toilet room shall be in chase where required pipes may be run at ceiling level in suitable gradient and supported on structural clamps. Spacing for clamps for such pipes shall be as follows:

Table 15: Pipe wise Spacing for Clamps

Pipes	Vertical Spacing (cm)	Horizontal Spacing (cm)
G.I. Pipes	300	240
P.V.C. Pipes	180	120
Lead pipes	120	120

a) Galvanized Pipes

Pipes shall be galvanized steel tubes, conforming to I.S.: 1239- 1979 (medium class) and quality certificates shall be furnished. Pipes shall be provided with all required fittings e.g. Tees, couplings, bends, elbows, Unions, Reducers, Nipples, Plugs. All G.I. waste pipes shall be terminated at the point of connection with the appliance with an outlet of suitable diameter.

b) Lead Pipes

- Where specified, lead pipes shall be used for waste and connections to anti- siphonage pipes and W.C. connections.
- Lead pipes shall be seamless drawn pipes conforming to IS. 404 (part-I) 1977. Weight and wall thickness shall be as follows:

Table 16: Weight and Wall Thickness Details for Lead Pipes

Nominal I/D (mm)	Wall Thickness	Wt. Kg/m
32	2.6	3.28
40	2.6	3.95
50	2.7	5.07
75	2.7	7.48
100	2.7	

- Lead pipes shall be straightened by wooden mandrel and bent to required shape by filling sand Connection between appliance, stacks or traps shall be made with solder joints. Solder shall be 64% lead and 36% pure tin. All lead waste pipes in exposed positions shall be

painted with one coat of red primer and two or more coats of synthetic enamel paint of approved quality and shade.

c) Polyethylene Pipes

- Where specified, polythene pipes shall be high-density polythene pipe confirming to IS: 4984-78. The details of the nominal outer diameter, weight and working pressure at 20 degree C shall be as per the above standards or as per manufacturers specifications subject to approval of the Project Manager/appropriate government authority appointed by GSCDL.
- Polythene pipes may be cold bending to a radius of not less than eight times of their external diameter. Pipes bent for smaller radius may be made by not bending.
- Fittings used for polythene pipes shall be compression moulded fittings matching to the above specifications or for higher diameter, fabricated as per required specifications.
- Jointing
Jointing and fixing for polythene pipes shall be made as per manufacturer's specifications but generally by means of butt welding or detachable nuts or flanged joints or screwed joints. The type of joint shall be used as per the site conditions. The ultimate finish of pipe shall be complete as directed by the Project Manager/appropriate government authority appointed by GSCDL.
- All pipes shall be tested after installation for a pressure equal to twice the maximum working pressure in the line.

d) Cement Concrete

Cast iron soil and waste pipes under floor, in concrete slabs and in wall chases (When cut specially for the pipe) shall be encased in cement concrete 1:2:4 (1 cement: 2 coarse sand: 4 stone aggregate 20mm size) 75 mm in bed and all-round. When pipes are running well above the structural slab, the encased pipes shall be supported with suitable cement concrete pillars of required height and size of intervals as directed by the Project Manager/appropriate government authority appointed by GSCDL.

e) Painting

- H.C.I. soil waste vent and rainwater pipes in exposed location, in shafts and pipe spaces shall be painted with two or more coats of synthetic enamel paint to give an even shade.
- Paint shall be of approved quality and shade where directed pipes shall be painted in accordance with approved pipe colour code.
- Waste pipes in chase shall be painted with two coats at bitumen paint, covered with polythene tape and a final coat of bitumen paint. Exposed pipes shall be painted with two or more coats or synthetic enamel paint.

- C.I. soil and waste pipes below ground and covered in cement concrete or lead pipes shall not be painted.

f) Cutting and Making Goods

Pipes shall be fixed and tested as building proceeds. The Contractor shall provide all necessary holes cut outs and chases in structural as building works proceeds. Wherever holes are cut or left originally, they shall be made good with cement concrete 1:2:4 (1 cement: 2 coarse sand: 4 stone aggregate 20 mm nominal size) or cement mortar 1:2 (1 cement: 2 coarse sand) and the surface restored as in original condition.

g) Testing

- Before use at site all C.I. soil pipes shall be tested by filling up with water for at least 10 minutes. After filling, pipes shall be struck with a hammer and inspected for blowholes and cracks. All defective pipes shall be rejected and removed from the site within 48 hours. Pipes with minor sweating shall be accepted at the discretion of the Project Manager/appropriate government authority appointed by GSCDL.
- Pipes shall be tested after installation, by filling up the stack with water. All openings and connections shall be suitable plugged. The total head in the stack shall however not 3m exceed.
- Alternatively, the Contractor may test all soil and waste stacks by a smoke testing machine. Smoke shall be pumped into the stack after plugging all inlet and connections. The top end shall however be left open. The stack shall then be observed for leakage and all defective pipes and fittings removed or repaired as directed by the Project Manager/appropriate government authority appointed by GSCDL.
- A test register shall be maintained and all entries shall be signed and dated by the Contractor and the Project Manager/appropriate government authority appointed by GSCDL.

Location and Sizes

The sizes given in the drawings shall be internal size of chamber. Unless otherwise specified, manholes and inspection drains, at all changes of direction of drains and where branch drain meets the Main drain. Chambers shall be of such size as to allow necessary examination and clearance of drains. The minimum internal sizes shall be taken as per details drawings, standards specified and local byelaws if any. In the absence of local byelaws, the code of practice for Ancillary Structures in Sewerage System shall be followed, the work shall be done strictly as per standard drawings and the following specifications:

Bed Concrete

Shall be in 1:4:8 cement concrete 150mm thick for inspection chambers, 230mm for depths up to 2.1m and 300mm for greater depths in case of manholes.

Brick Masonry

Brickwork shall be with best quality table molded bricks in 1:6 cement mortar as per the specification for brick masonry.

Plaster

Inside of the walls of chamber/manhole shall be plastered with 15mm thick cement plaster 1:3 mixed with waterproofing material and finished smooth with a floating coat of neat cement.

Benching

Channels and benching shall be done in cement concrete 1:2:4 rendered smooth with neat cement. The following sizes of channels for the bench shall be adopted:

Size of Drain Depth of Center Depth at sides. i.e. at walls

- dii. 100 mm (4") 150mm (6") 250 mm (10")
- diii. 150mm (6") 200mm (8") 300 mm (12")

Chamber/Manhole Cover

Covers shall be of heavy duty FRC with lifting hooks as per the details given in the drawing / manufacturers leaflet and fixed on the frame embedded in concrete. Cover placed on the frame shall be airtight. The class of frame and cover shall be as per bill of quantities.

Steps

PVC steps heavy duty shall be provided whenever the depth of the manhole/chamber is more than 1.2m.

Drop Connections

In case the difference in invert levels between main drain and the branch line requires a drop more than 600mm, a drop connection should be provided with cast iron or stoneware four way junction, fixed at right angles to the drop pipe at the level where branch pipe enters the manhole. Access for cleaning the bend should be provided at finished ground level.

- div. Drop connections shall be provided between branch sewer and main sewer or in the main sewer itself in the steep ground when the difference in the invert level of the two exceeds 45 cm of the required size.
- dv. Drop connections from the gully trap to main sewer on rectangular manholes shall be made inside the manhole and shall have H.C.I. special type door on top and heel rest bend at bottom connected by a H.C.I. pipe. This pipe shall be supported by holder bat clamp at 180 cm intervals with one clamp for each drop connection. All joints shall be lead caulked joints 25 cm deep.
- dvi. Drop connections from branch sewer to main sewer shall be made outside the manhole wall with glazed stone ware pipe tee connection, vertical pipe and bend at the bottom. The top of the tee shall be finished up to the surface level and provided with a C.I. hinged type frame and cover 30 cm x 30cm. The connection shall be embedded in the cement concrete 1:2:4 mix 15 cm all-round the pipe and tee upto the surface chamber of the tee.

Drop connection made from vertical stack directly into the manhole shall not be considered as drop connection.

Gully Trap Chambers

Stoneware gully traps of specified size and as per IS 651 shall be provided. It shall be fixed on 15cm. thick and 70cm square 1:4:8 cement concrete bedding and the gully outlet shall be jointed similar to the jointed similar to the jointing stoneware pipes. A brick masonry chamber 300 x 300 mm (internally) shall be constructed in ½ brick masonry with 1:6 cement mortar and the space between the trap and the wall shall be filled up with 1:3:6 concrete and the upper portion of the chamber shall be finished with neat cement mortar. The corners and the bottom of the chamber shall be rounded off so as to slope towards the grating and the bottom of the inspection cover shall not be less than 230 mm. In addition to 150 mm x 150 mm CI grating, the chamber shall have a CI frame cover (300 x 300 mm). It shall then be placed on top of the brick masonry.

Floor Traps

The uPVC floor trap shall be of multi-inlet and one outlet type either fabricated or molded as per BOQ. The floor trap shall be deep seal type with effective seal of minimum 50 mm. The waste from sanitary fixtures shall be directly discharged to floor trap. The jointing of waste pipe to floor drain shall be done as per manufacturer's instructions. The height riser fitting shall be made use, wherever the floor drain located in deep – sunk floors or is suspended ceiling, the PVC floor trap shall be of reputed make and preferably of the same make as of the pipes used.

The floor trap shall be provided with 150x150mm square brass CP grating with rim of approved design. Minimum thickness of the grating shall be 4 to 5 mm.

Inspection Chambers

The inspection chambers shall be measured in number and the rate quoted shall also be per number only. The quoted rate shall include the cost of all the following items:

- dvii. Bed concrete
- dviii. Brick work
- dix. Plastering
- dx. Concrete benching channeling
- dxii. Inspection chamber cover and frame including PCC bed for fixing the frame & steps.
- dxiii. Providing holes and embedding pipes for all connections
- dxiiii. Excavation, refilling, necessary de-watering and disposing off extra material to a place as directed by the Project Manager/appropriate government authority appointed by GSCDL.
- dxiv. Curing
- dxv. Testing

Manhole

Shall be measured in numbers. The depth of manhole shall be reckoned from invert of channels to the top manhole cover. Quoted rates shall cover the rate of +/- 240 mm on the depth specified and also the cost of all the following items;

- dxvi. Bed concrete
- dxvii. Brick Work

- dxviii. Plastering
- dxix. Concrete benching and channeling including drop connections.
- dxix. Supply and fix C.I. steps.
- dxxi. Providing holes and embedding pipes for all the connections.
- dxix. Excavation, refilling, necessary de watering and disposing off extra material to a place as directed by Project manager/ appropriate government authority appointed by GSCDL.
- dxix. Curing
- dxix. Cost of FRC frame and cover and embedding the frame in concrete bed & steps.
- dxix. Testing.

qqqqq) All manholes, chambers, septic tanks and other such works as specified shall be constructed in RR Stone Masonry (1:6) I.S. (1 cement: 6 coarse sand).

rrrrr) All manholes, chambers, septic tanks, etc, shall be supported one base of cement concrete of such thickness and mix.

sssss) All manholes shall be provided with cement concrete benching in 1:2:4 mix (1 cement 2 coarse sand 4 stone aggregate 20 mm nominal size) The benching shall have a slope of 10 cms towards the channels. The depth of the channel shall be full diameter of the pipe. Benching shall be finished with a floating coat of neat cement.

ttttt) All manholes shall be plastered with 25 mm thick cement mortar 1:3 mix (1 cement 3 coarse sand) in finished with a floating coat of neat cement inside. Manholes shall be plastered outside as above but with rough plaster.

uuuuu) All manholes with depths greater than 1 m shall be provide with Ferro Cement Foot Steps.

vvvvv) All manholes shall be provided with cast iron covers and frames and embedded in reinforced cement concrete slab. Weight of cover and frame shall be approximately chosen.

Size of Manhole should not be less than 1500 x 900 mm in normal circumstances. Circular manhole shall be construction with minimum 1 meter internal dia.

Septic Tanks

Design Considerations

- dxix. General - In unsewered areas, every house should have arrangements for its sewage being treated in a septic tank, effluent from which should be given secondary treatment either in a biological anaerobic filter, on the land or in a sub-surface disposal of ical filter, upflow system.

wwwww) Surface and subsoil water should not find way into the septic 'tank.

xxxxx) Normally, the septic tanks are designed for foul sewage (faecal matter and urine) . Sullage wastes may be distributed crudely by throwing on the gardens or grassed areas and so dispersed and absorbed, or may

be drained to a seepage pit or dispersion trench from which it overflows into or is absorbed by the surrounding soil.

NOTE - Pits and trenches for the disposal of sullage shall be so located as to avoid contamination of watercourses or underground water supplies.

yyyyyy) Under no circumstances should effluent from a septic tank be allowed into an open channel drain or body of water without adequate treatment.

zzzzzz) Wastes containing excessive detergents, grease and disinfectants should not be treated in septic tank as they adversely affect the anaerobic decomposition.

aaaaaaa) Where the incoming drain is steep due to site conditions, the last section of the drain, at least 12 m in length should not be laid at a gradient not steeper than 1 : 50 in order to minimize turbulence in the tank.

bbbbbbb) When the pumping arrangement is provided before the septic tanks the sewage from the pump should not be discharged directly into the septic tank. Normally, the discharge from the pump is first lead into a tank and then the sewage is allowed to flow into the septic tank gravitationally and the provisions of 3.1.5 shall also be observed.

- The rate of pumping of sewage shall not exceed three times D.W.F.

ccccccc) Pipe Diameter - For practical considerations, a minimum nominal diameter of 100 mm is recommended.

dxxvii. Layout

ddddddd) Tie layout should be as simple and direct as practicable.

eeeeeee) The pipes should be laid, as far as possible, in straight lines in both vertical and horizontal planes; however, where bends are unavoidable, they should be long radius bend with cleaning eyes. Anything that is likely to cause irregularity of flow should be avoided.

ffffff) At junctions of pipes in manholes, direction of flow from a branch connection should not make an angle exceeding 45' with the direction of flow in the main pipe.

ggggggg) A typical arrangement of the layout of septic tank sewerage system is illustrated in Fig. 7.

dxxviii. Location of Septic Tank

hhhhhhh) Septic tank should be located at a place open to sky, as far away as possible from the exterior of the wall of building and should not be located in swampy areas or areas prone to flooding. It should also be accessible for cleaning.

dxxix. Septic Tank Design

iiiiiii) Sewage Flow

- The maximum flow to the tank is based on the number of plumbing fixtures discharging simultaneously. For this purpose various sanitation facilities are equated in terms of fixtures units. Fixture equivalents are given in Figure 1.

NOTE - Fixture unit is a quantity in terms of which the load producing effect of different plumbing fixtures on the plumbing system are expressed on some arbitrarily chosen scale, In the design of septic tank, it is taken as 3 litres per minute.

FACILITY	EQUIVALENT FIXTURE UNIT
Water closet	1
Bath	1/2
Wash basin/kitchen sink	1/2
Urinal (with autoflush)	1
Urinal (without autoflush)	1/2
Slop sink	1
Laboratory sink	2
Combination fixture	1
Shower bath	1
Bath tub	2
Drinking fountain	1/2
Ablution tap	1/2
Dish water	1/2

Figure 1: Fixture equivalent

- The estimated number of fixture units and the number of fixture units that contribute to the peak discharge in small installations for residential housing colonies serving up to 300 persons is given in Figure 2.

No. of Users	No. of Households	No. of Fixture Units	PROBABLE PEAK DISCHARGE lpm
(1)	(2)	(3)	(4)
50	10	20	108
100	20	40	216
150	30	60	324
200	40	80	432
300	60	120	648

NOTE 1 — Probable peak discharge is based on 60 percent fixtures units discharging simultaneously

NOTE 2 — Each household consisting of 5 persons may have 1 WC, 1 bath and 1 wash basin/kitchen sink.

Figure 2: Fixture units

jjjjjj) Sedimentation

- The surface area of the tank required will be 0.92 m² for every 10 litres per minute of peak flow rate at a temperature of 25%.

- A minimum depth of sedimentation shall be 250 to 300 mm.

Dimensions of Septic Tank

- For rectangular septic tanks, the length of the tank shall be 2 to 4 times the width.
- For circular tanks the minimum diameter shall not be less than 1.35 m and operating depth shall not be less than 1.0 m.
- Inlet - The design of septic tank inlets shall be such as to introduce the crude sewage with the least possible disturbance of the settled sludge or the surface scum. For tanks not more than 1200 mm wide, T-shaped dip-pipe not less than the nominal bore of incoming drain may be provided. The pipe shall be fixed inside the tank, with top limb rising above scum level and the bottom limb extending about 300 mm below the top water level. Typical sketch of the septic tank is given in Fig. 3. for tanks in excess of 1200 mm in width, two or more submerged inlets are preferable. Typical sketch of the septic tank is shown in Fig. 6. One method of providing such inlets is by the use of submerged bends of the same nominal bore (not less than 100 mm) set as closely together as practical in a shallow sump formed within a small benched chamber (see Fig. 6). It is important that the invert of the benched channel be 58 mm above the top water level and the inlet ends of the submerged bends should be set flush with the floor of the sump which should be not less than 75 mm below top water level. The sump may be the full width of the chamber, but should not exceed 1.5 times the nominal bore of the inlet bends in other direction. The inverts of the outlet ends of these bends should be between 300 and 525 mm below top water level in the tank. A baffle should be provided 150 mm from the inlet end of the tank, extending 150 mm below the invert of the inlet pipes and 150 mm above the top water level.
- Outlet - The final outlet for tanks which are less than 1 200 mm wide should be by 100 mm nominal bore dip-pipe fixed inside the tank with a top limb rising above scum level and the bottom limb extending to about 1/3 of the liquid depth below top water level. The invert of the outlet pipe shall be 50 mm below the invert of the inlet pipe
- For wider tanks, it is necessary to use a weir outlet extending the full width of the tank and protected by a scumboard fixed 15~ 1mm from the weir and extending 150 mm above and 1/3 of liquid depth below the top water level. A deflector should be formed either in the structure of the end (outlet) wall or by a purpose-made deflector to prevent rising particles from reaching the outlet weir. This deflector should be located 150 mm below the base of the scum board and protrude 150 mm into the tank

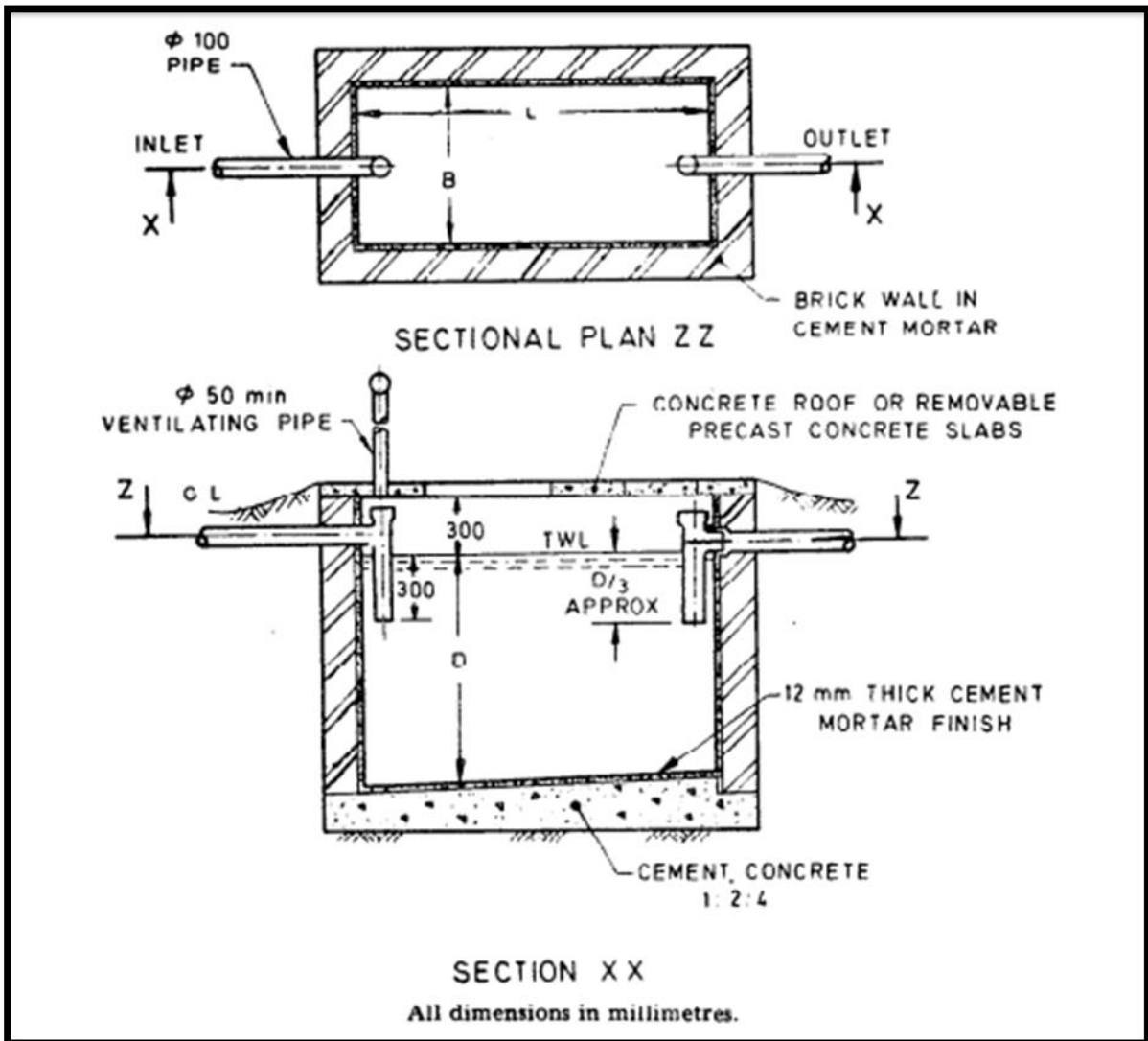


Figure 3: Typical sketch of Septic Tank upto 20 users

- dxxx. Partitions - Where the capacity of a septic tank exceeds 2 000 litres, the tank may be divided into two chambers by means of a fixed durable partition. The partition shall be located so that the capacity of the first chamber i.e., twice that of the second chamber. Suitable openings rectangular or circular with minimum dia 100 mm and maximum 150 mm shall be provided in the partition at approximately 300 mm below TWL.
- dxxxi. For population of over 100, duplicating tanks, each providing half the total calculated capacity required, should be installed and operated in parallel. This arrangement permits - 11 the flow to be passed through one unit while the other is being desludged. To enable the top water to be decanted when desludging, a decanting valve should be provided in the wall dividing the two tanks; the invert of this valve should be 625 mm below TWL.
- dxxxii. Fret-Board - A minimum free board of 300 mm should be provided.
- dxxxiii. Access Openings and Cover - Each compartment of a septic tank shall be provided with a rectangular access opening measuring, not less 455 x 610 mm or a circular opening 500 mm diameter. The cover to access openings shall be of reinforced concrete or of cast iron. A cover shall incorporate a suitable lifting device and when in place after installation of the septic tank shall fit neatly and be sealed to prevent the ingress of water.

dxxxiv. Ventilating Pike - Every septic tank shall be provided with * ventilating pipe of at least 50 mm diameter. The top of the pipe shall be provided with a suitable cage of mosquito proof mesh. The ventilating pipe shall extend to a height which would cause no smell nuisance to any building in the area. Generally the ventilating pipe may extend to a height of about 2 m when the septic tank is at least 20 m away from the nearest building and to a height of 2 m above the top of the building when it is located closer than 20 metres. The ventilating pipe may also be connected to the normal soil ventilating system of the building where so desired.

Septic Tank Construction

dxxxv. Floor - It is essential that the floor of the tank be water tight and of adequate strength to resist earth movement and to support the weight of the tank ,walls and contents.

lllllll) The floor may be of cement concrete of minimum M 15 grade (see IS : 456-1978* latest codes to be referred) and a minimum slope of 1 : 10 may be provided towards the sludge outlet to facilitate desludging.

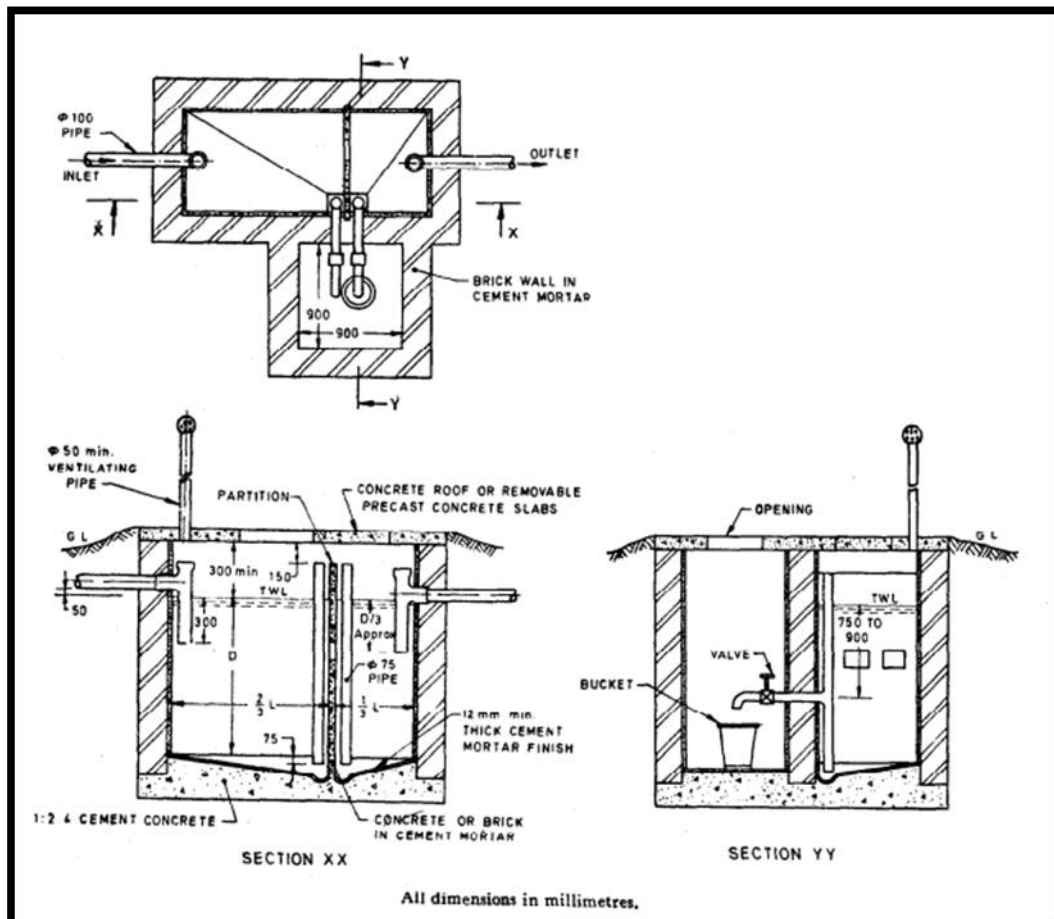


Figure 4: Typical sketch of Septic Tank upto 50 users

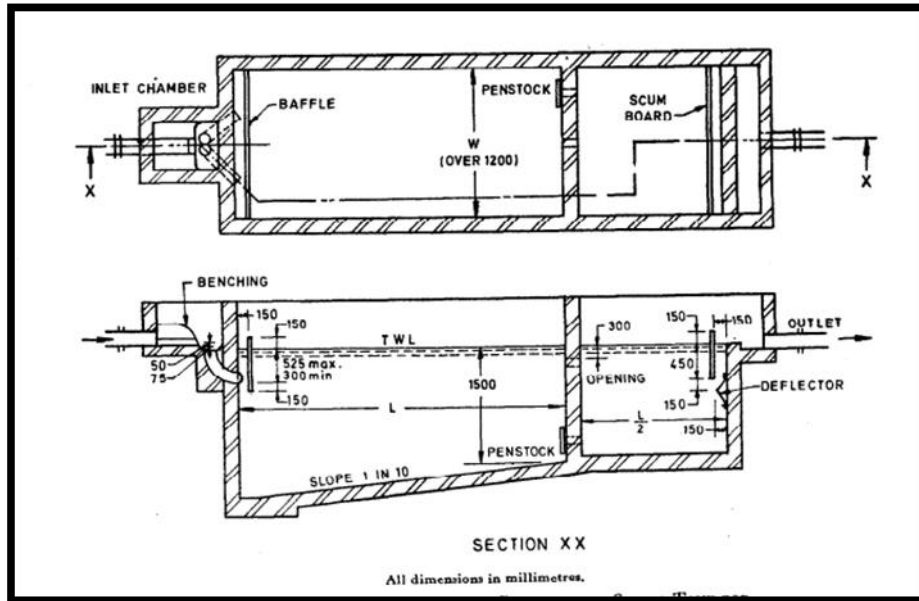


Figure 5: Typical sketch of Septic Tank over 50 users

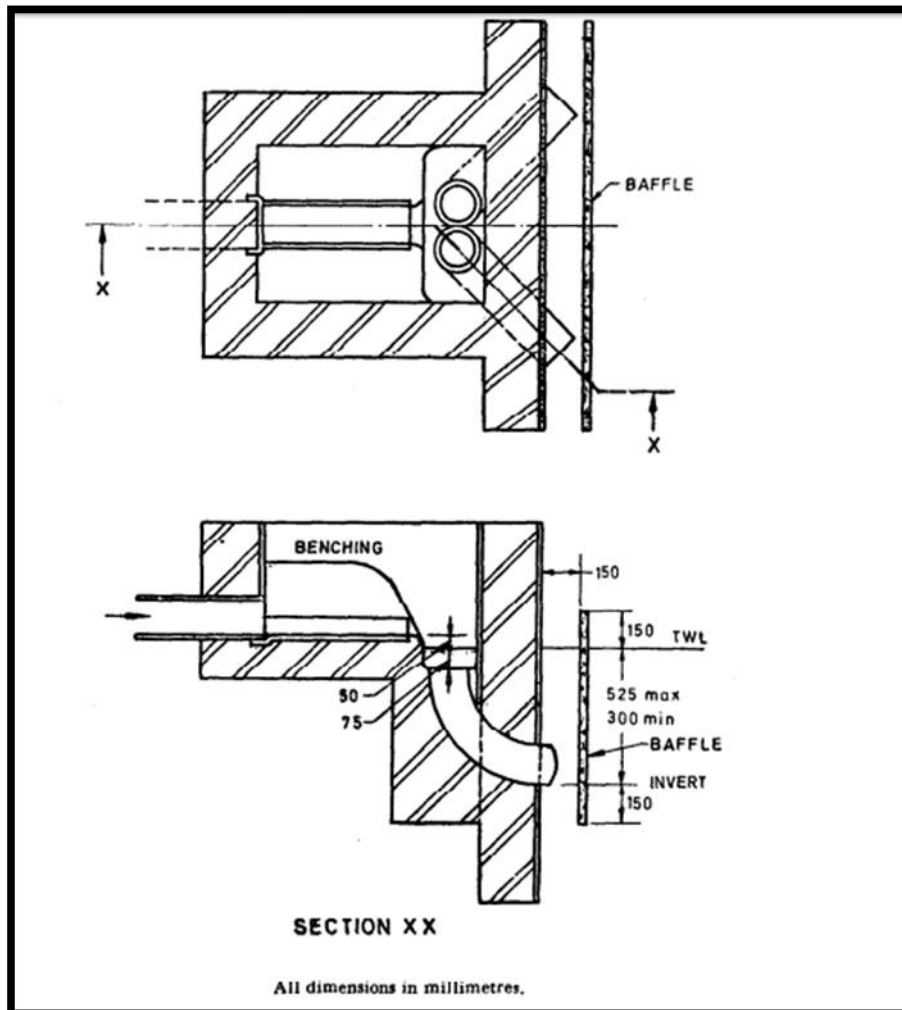


Figure 6: Twin Inlet for tanks in excess of 1200 mm width

- dxxxvi. Walls - The walls should be of such thickness as to provide adequate strength and water tightness.

mmmmmm) Walls built out of brick should not be less than 200 mm thick and should be plastered to a minimum thickness of 12 mm inside and outside with cement mortar not weaker than 1 : 3; where they are built out of the stone masonry. They should have a minimum thickness of 370 mm.

Sludge Withdrawal

- dxxxvii. Half yearly or yearly desludging of septic tank is desirable. Small domestic tanks, for economic reasons, may be cleaned at least once in 2 years provided the tank is not overloaded due to use by more than the number for which it is designed.

NOTE - Frequent desludging inhibits the anaerobic action in the tank. Normally, the tanks are cleaned when the sum of the depth of the scum and the sludge is observed to exceed half the depth of the tank.

- dxxxviii. A portion of sludge not less than 25 mm in depth should be left behind in the tank bottom which acts as the seeding material for the fresh deposits.

- dxxxix. The digested sludge should be withdrawn through a dip pipe of not less than 150 mm dia under a hydrostatic pressure of at least 450 mm. The sludge pipe shall deliver the sludge to the sump and be provided with a delivery valve to draw the sludge as required. Portable pumps may also be used for desludging in which case there will be no need for sludge pipe or sludge pump. Manual handling of sludge should be avoided.

nnnnnn) When removal of the sludge is carried out the scum in the first tank should not be disturbed more than necessary, this scum is needed to ensure efficient operation.

- dxl. Sludge from septic tanks may be delivered into covered pits or into a suitable vehicle for removal from the site. Spreading of sludge on the ground in the vicinity should not be allowed.

Commissioning of Septic Tank

- dxli. The sewerage system should be complete and ready for operation before connection is made to the building.

- dxlii. The tank should be filled with water to its outlet level before the sewerage is let into the tank. It should, preferably, be seeded with small quantities of well digested sludge obtained from septic tanks or sludge 16 IS : 2470 (Part 1) - 1985 digestion tanks. In absence of digested sludge a small quantity of decaying organic matter, such as digested cow dung may be introduced.

Disposal of Septic Tank Effluent

- dxliii. Effluent from the septic tank shall be disposed of by one of the methods given in IS : 2470 (Part 2)-1985*.

SIZES OF SEPTIC TANK

A-1. Recommended sizes of septic tanks for 20 users are given in Table 5.

TABLE 5 RECOMMENDED SIZES OF SEPTIC TANK FOR 20 USERS

No. of Users	LENGTH	BREADTH	LIQUID DEPTH (CLEANING INTERVAL OF)	
			1 Year	2 Year
(1)	(2)	(3)	(4)	(5)
	m	m	m	m
5	1.5	0.75	1.0	1.05
10	2.0	0.90	1.0	1.40
15	2.0	0.90	1.3	2.00
20	2.3	1.10	1.3	1.80

NOTE 1 — The capacities are recommended on the assumption that discharge from only WC will be treated in the septic tank.

NOTE 2 — A provision of 300 mm should be made for free board.

NOTE 3 — The sizes of septic tank are based on certain assumptions (see 3.4), while choosing the size of septic tank exact calculations shall be made.

*Code of practice for installation of septic tank : Part 2 Secondary treatment and disposal of septic tank effluent (second revision).

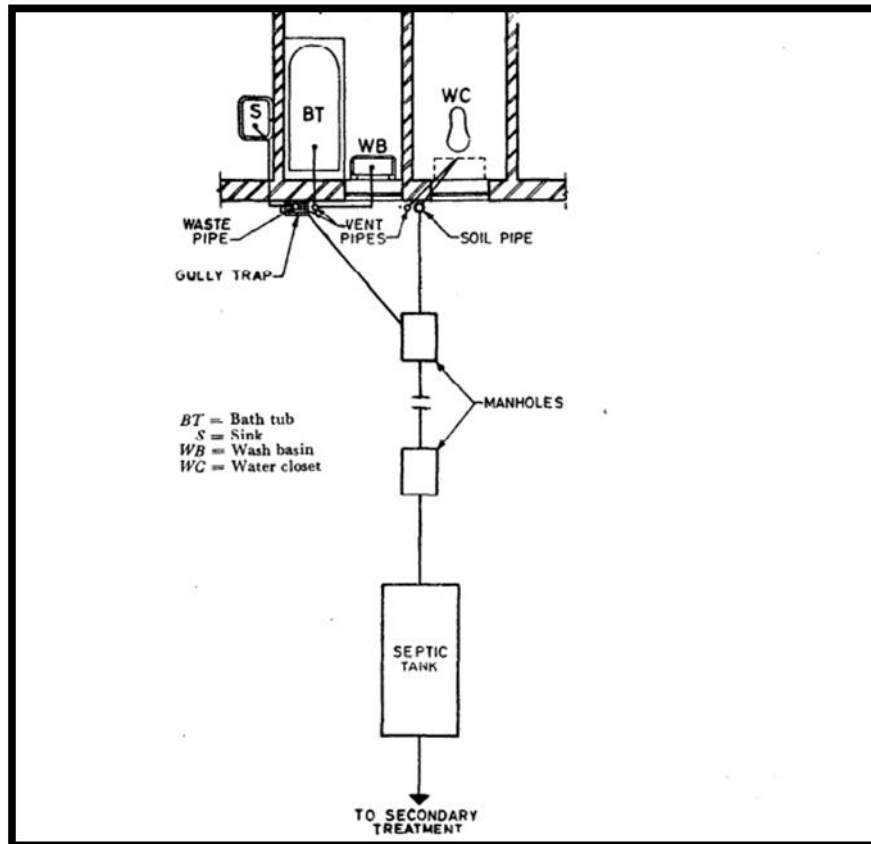


Figure 7: Typical Layout of a Septic Tank Sewerage System

Cement Concrete and Masonry Works (for manholes and chambers, etc.)

- dxliv. Water: Water used for all constructional purpose shall be clear and free from
dxlv. oil, acid, alkali, organic and other harmful matters, which can deteriorate the strength and / or durability of structure. In general, the water suitable for drinking purpose shall be considered as good enough for constructional purposes.
- dxlvi. Aggregate For Concrete: The aggregate for concrete shall be in accordance with I.S. 383 and I.S. 515 in general; these shall be free from all impurities that may cause corrosion of the reinforcement. Before actual use these shall be washed in water, if required as per the direction of Project Manager/appropriate government authority appointed by GSCDL. The size of the coarse aggregate shall be done as per IS 383.
- dxlvii. Sand: Sand for various constructional purposes shall comply in all respects with I.S. 650 and I.S. 2116. It shall be clean, coarse hard and strong, sharp, durable, uncoated, free from any mixture of clay, dust, vegetable matter, mica, iron impurities soft or flaky and elongated particles, alkali, organic matter, salt, loam and other impurities which may be considered by the Project Manager/appropriate government authority appointed by GSCDL as harmful for the construction.
- dxlviii. Cement: The Cement used for all construction purpose shall be ordinary Portland cement or rapid hardening Portland cement conforming to I.S. 269. (e) Mild Steel Reinforcement. The mild steel for reinforcement bars shall be in the form of round bars conforming to all requirements of IS 432 (Grade I).
- dxlix.** Bricks: Bricks shall uniform colour, thoroughly burnt but not over burnt, shall have plan rectangular faces with parallel sides and sharp right- angled edges. They should give ringing sound when struck. Brick shall not absorb more than 20% to 22% of water, when immersed in water for 24 hours. Bricks to be used shall be approved by the Project Manager/appropriate government authority appointed by GSCDL.
- dl.** Other Materials: Other materials not fully specified in these specifications and which may be required in work shall conform to the latest IS All such material shall be approved by the Project Manager/appropriate government authority appointed by GSCDL before use.

ooooooo) Cement Concrete (Plain or Reinforced)

- Cement concrete pipes bedding, cradles, foundations and R.C.C. slabs for all works shall be, mixed by a mechanical mixer where quantities of the concrete poured at one time permit, hand mixing on properly constructed platforms may be allowed for small quantities by the Project Manager/appropriate government authority appointed by GSCDL.
- Concrete works shall be of such thickness and mix
- All concrete work shall be cured for a period of at least 7 days. Such work shall be kept moist by means of gunny bags at all times. All pipes trenches and foundations shall be kept dry during the curing period.

ppppppp) Masonry Work

- Masonry work for manholes, chambers, septic tanks and other such works as required shall be constructed from stone. All joints shall be properly raked to receive plaster.

qqqqqq) Cement Concrete for Pipe Support

- Wherever specified or shown on the drawings all pipes shall be supported in bed and all round or in haunches. The thickness and mix of the concrete shall be of appropriate width of the bedding.
- Unless otherwise directed by the Project Manager/appropriate government authority appointed by GSCDL, cement concrete for bed, all round or in haunches shall be laid as follows.
- R.C.C. Pipes or C.I. pipes may be supported on brick masonry or precast R.C.C. or in situ cradles.
- Pipes in loose soil or above ground shall be supported on bricks or stone masonry pillars.

Table 17: Mix of Concrete for Pipe Support

Pipes	Upto 1.5 m depth	Upto 1.5 m depth	Beyond 3 m depth
Stoneware pipe in open ground(no sub soil water)	All round 1:3:6	In haunches 1:3:6	All round 1:2:4
RCC or SW pipes in sub soil water	All round 1:3:6	In haunches 1:3:6	All round 1:2:4
GI pipe (in all conditions)	Sand filling	Sand filling	Sand filling
RCC pipes or CI pipes under road or building	All round 1:3:6	In haunches 1:3:6	All round 1:2:4
(1=1 cement ; 3-6 = coarse sand ; 6-12 = stone aggregate 20 mm nominal size)			

Gully Trap Chamber

Gully trap chambers shall be measured in numbers and the rate quoted shall also be per number only. The quoted rate shall include the cost of all the following its:

- dli. Bed concrete. \
- dlii. Brick Work
- dliii. Plastering
- dliv. Gully trap and grating
- dlv. Concrete cover and frame
- dlvi. Providing holes and embedding pipes for all connections.
- dlvii. Excavation, refilling, necessary de-watering and disposing off extra material to a place as directed by
- dlviii. Project Manager/appropriate government authority appointed by GSCDL.

Ductile Iron Pipes & Fittings

Material

Ductile iron Water supply and Irrigation & Fittings shall confirm to IS 8329 & IS 9523.

Laying and Jointing

The pipes shall be buried underground, floor or as shown on the drawing. Ductile iron pipes shall be laid and jointed with push on joint using rubber ring joints conforming to IS 5382. The pipe spigot is pushed into the socket with the use of a fork or a rack lever machine. Clean any sand, dirt, grease or debris from the socket end and rubber ring. Insert rubber ring with groove over bead in rubber ring seat. Check position of gasket to assure it is completely seated in the groove with no raised areas. Wipe film of lubricant over inside of the rubber ring. Assemble the pipes to stop line on the spigot. This should be done by a lever bar or other approved devices. The joint is sealed. The pipes shall never be dropped in the trenches it is to be placed carefully into positions. All fittings viz, tees, bends, caps, plugs, or other fittings that change the direction of flow or stop the flow should be restrained or blocked.

Technical Specifications - Excavation and Pipelines (Water,Sewage,etc.)

Excavation

The excavation for pipe works shall be open cutting unless the permission of the Project Manager/appropriate government authority appointed by GSCDL for the ground to be tunneled is obtained in writing. Where sewers have to be constructed along narrow passages, the Project Manager/appropriate government authority appointed by GSCDL may order the excavation to be made partly in tunnel and in such cases the excavated soil shall be brought back later on for refilling the trenches or tunnel.

Opening out Trenches

In excavation the trenches, etc. the solid road metaling, pavements, curbing etc. and turf is to be placed on one side and preserved for reinstatement when the trenches or other excavation shall be filled up. Before any road metal is replaced, it shall be carefully shifted. The surface of all trenches and holes shall be restored and maintained to the satisfaction of the Project Manager/appropriate government authority appointed by GSCDL and of the owners of the roads or other property traversed and the Contractor shall not cut out or break down and live fence of trees in the line of the proposed works but shall tunnel under them, unless the Project Manager/appropriate government authority appointed by GSCDL shall order to the contrary.

The Contractor shall grub up and clear the surface over the trenches and other excavations of all trees, stumps roots and all other encumbrances effecting execution of the work and shall remove them from the site to the approval of the Project Manager/appropriate government authority appointed by GSCDL.

Obstruction of Roads

The excavation for pipe works shall be open cutting unless the permission of the Project Manager/appropriate government authority appointed by GSCDL for the ground to be tunneled is obtained in writing. Where sewers have to be constructed along narrow passages, the Project Manager/appropriate government authority appointed by GSCDL may order the excavation to be made partly in tunnel and in cases the excavated soil shall be brought back later on for refilling the trenches or tunnel.

Removal of Filth

All night soil, filth or any other offensive matter met with during the execution of the works, immediately removed after it is taken out of any trench, sewer or cess pool, shall not be deposited on to the surface of any street or where it is likely to be a nuisance or passed into any sewer or drain but shall be at once put into the Carts and removed to a suitable place to be provided by the Contractor.

Excavation to be taken to Proper Depths

The trenches shall be excavated to such a depth that the pipes shall rest on concrete or on firm bedding as described in the several clauses relating to these to so that the inverts may be at the

levels given in the sections. In bad ground the Project Manager/appropriate government authority appointed by GSCDL may order the Contractor to excavate to a greater depth and to fill up the excavation to the level of the sewers with concrete, broken stone, gravel or other materials.

Refilling

After the pipes or other work has been laid and proved to be water tight, the trench or other excavations shall be refilled. Utmost care shall be taken in doing this, so that no damage shall be caused to sewer site and other permanent work. The filling in the hunches and upto 75 cm above the crown of the sewer shall consist of the finest selected materials placed carefully in 15 cm layers and flooded and consolidated. After this has been laid, the trench and other excavation shall be refilled carefully in 15 cm layers with materials taken from the excavation, each layer being watered to assist in the consolidation unless the Project Manager/appropriate government authority appointed by GSCDL shall otherwise direct.

The Contractor to Restore Settlement and Damages

The Contractor shall at his own costs and charges make good promptly during the whole period the works are in hand, any settlement that may occur in the surfaces of roads, berms, footpaths, gardens, open spaces etc. whether public or private caused by his trenches or by his other excavations and he shall be liable for any accidents caused thereby. He shall also at his own expenses and charges repair and make good and damage done to buildings and other property.

Disposal of Surplus Soil

The Contractor shall at his own costs and charges provide places for disposal of all surplus materials not required to be used on the works. As each trench is refilled, the surplus soil shall be immediately removed, the surface properly restored and roadways and sides left clear.

Timbering of Sewer and Trenches

- dlix. The Contractor shall at all times support efficiently and effectively the sides of the sewer trenches and other excavations by suitable timbering, piling and sheeting and they shall be close, timbered in loose or sandy strata and below the surface of the sub soil water level.
- dlx. All timbering sheeting and plinth with their walls and supports shall be of adequate dimensions and strength and fully braced and strutted so that no risk of collapse or subsidence of the walls of the trench shall take place.
- dlxi. The Contractor shall be held responsible and will be accountable for the sufficiency of all timbering, branches, sheeting and piling used as also for all damage to persons and property resulting from improper quality, strength, placing, maintaining or removing of the same.

Shoring of Buildings

The Contractor shall shore up all buildings, walls and other structures, the stability of which is liable to be endangered by the execution of the work and shall be fully responsible for all damages to persons or property resulting from any accident.

Removal of Water from Sewer, Trench etc.

The Contractor shall at all times during the progress of the work keep the trenches and excavations free from water which shall be disposed of by him in a manner as will neither cause injury to the public health nor to the public or private property nor to the work completed or in progress nor to the surface of any roads or streets, nor cause any interference with the use of the same by the public.

Width and Depth of Trench

The Project Manager/appropriate government authority appointed by GSCDL shall have the power of giving an order in writing to the Contractor to increase the maximum width for excavation in trenches for various classes of sewer, manholes and other works in certain lengths, to be specifically laid down by him, where on account of bad ground or other unusual conditions, he considers that such increased widths are necessary in view of the site conditions.

Sanitary Installation and Fixtures

General

All fixtures shall be fixed in a neat workman like manner true to line and as recommended by the manufacturer or shown in the drawings. Care shall be taken to fix all fixtures, brackets and accessories by using proper wooden cleats, raw plugs, bolts and nuts.

Care shall be taken in fixing all approved chromium plated (CP) fixtures and accessories so as not to leave any tool marks or damages on the finish. All such fixtures shall be tightened with fixed spanners. Use of 'Stiltson' type wrenches with toothed jaws shall not be allowed.

Testing of Sanitary fixtures shall be thoroughly done after connection of drainage and water supply system to it. All fixtures shall be thoroughly fixed and leakage if any in pipes, valves and waste fittings corrected to the entire satisfaction of the Project Manager/appropriate government authority appointed by GSCDL.

Upon completion of the work, all labels, stickers, plasters, etc. shall be removed from the fixtures and all fixtures shall be cleaned with soap and water so as to present and clean toilet.

European Type Water Closet

The closet shall be white (as per BOQ) vitreous China wall mounted water closet with exposed flushing cistern with dual flush type and water saving type as per IGBC and shall be of the best quality manufactured by an approved firm, and fixed by approved means. It shall have 100 mm dia porcelain 'P' trap with effective seal. Each closet shall be provided with the following accessories;

- dlxii. Double flapped heavy plastic seat cover of approved quality and color with rubber buffers and C.P. brass screws fixed to the pan
- dlxiii. 32mm dia CP flush valve.
- dlxiv. CI chair brackets

Mode of Measurement

These items shall be measured in numbers and the rate quoted shall be per number only. The quoted rate shall include.

- dlxv. The cost of W.C. pan with 32mm dia CP flush valve & CI brackets

- dlxvi. Plastic seat cover
- dlxvii. Jointing and fixing materials, including painting of brackets.

Wash Basins

They shall be of 50% colored (as per BOQ) vitreous China best quality manufactured by an approved firm and size as specified. They shall be supported on a pair of C.I. brackets of approved design.

Each washbasin shall be provided with 1 No. CP 15mmdia pillar tap, 15 mm CP brass angle cock, 450 mm long 8mmdia CP inlet pipe, 32 mm CP waste coupling, 32mmdia CP bottle trap with CP extension pipe, unless otherwise specified.

Mode of Measurement

These items shall be measured in number and rate quoted shall be per number only. The quoted rate shall include:

- dlxviii. The cost of washbasin with brackets and other items stated.
- dlxix. Jointing and fixing materials.
- dlxx. Painting of brackets.

Kitchen Sinks

These shall be of stainless steel of best quality of specified make and shall be supported on necessary brackets. Each sink shall be provided with 15mmdia CP Sink mixer wall mounted type with swivel spout, CP flange, 40mmdia CP waste coupling, 40mmdia heavy cast CP bottle trap with CP extension pipe, CP wall flange.

Mode of Measurement

These items shall be measured in numbers including all the items mentioned above and rate quoted shall be per number only. The quoted rate shall include all accessories as mentioned, jointing and fixing materials and fixing materials etc., complete.

Bib – Cocks

The Bib - cocks shall be of 15mmdia brass CP with CP wall flanges.

Mode of Measurement

These items shall be measured in numbers and rate quoted shall be per number only. The quoted rate shall include jointing and fixing materials etc., complete

Urinals

They shall be of 50% colored (as per) vitreous China best quality manufactured by an approved firm and size as specified. They shall be supported by Rag bolts of approved design. The urinal shall be provided with Electrical Sensor Battery operated flushing unit & CP accessories as described.

- dlxxi. Urinals shall be lipped type half stall white glazed vitreous China of approximate Size 630 x 420 x 380 mm size.

- dlxxii. Half stall Urinals shall be provided with 15 mm diameter C.P. spreader, 32 mm diameter C.P. domical waste and C.P. brass bottle trap with pipe and wall flange and shall be fixed to wall by one C.I. bracket and two C.I. wall clips as recommended by manufacturers' or as directed by the Project Manager/appropriate government authority appointed by GSCDL.
- dlxxiii. Half stall urinals shall be fixed with C.P. brass screws and shall be provided with 32mm diameter domical waste leading to urinals trap.
- dlxxiv. Urinals shall be flushed by means of automatic porcelain flushing cistern or exposed or concealed type urinal flush valve, as specified in manual flushing system.
- dlxxv. Flush valve for urinal shall be provided
- dlxxvi. Flush pipes of flushing cistern with sizes of main and branch flush pipe shall be as follows:

Table 18: Flush Pipes Sizes

No. of urinals in Range	Capacity of cistern litres	Size of main flush pipe	Size of branch flush pipe	Size of connection urinal
One	5	-	-	15
Two	10	20	-	15
Three	10	25	-	15

- dlxxvii. Alternatively, Urinals may be flush with flush valves, exposed or concealed type.
- dlxxviii. Waste pipes for urinals shall be any one of the following:

rrrrrr) G.I. pipe
ssssss) Rigid P.V.C

- dlxxix. U. P.V.C. or PE pipes
Waste pipes may be exposed on wall or concealed in chase. Specifications for waste pipes shall be same as given in Sikkim PWD Specifications

Mode of Measurement

These shall be measured in numbers and shall include all Accessories as described.

Toilet Accessories

- dlxxx. Work under this section shall consist of furnishing all material and labour as necessary and required to completely install all sanitary fixtures, brass and chromium plated fittings and accessories, as specified hereinafter.
- dlxxxi. Without restricting to the generality of the foregoing the sanitary fixtures shall include all sanitary fixtures, C.P. fittings and accessories etc. necessary and required for the building.
- dlxxxii. Whether specifically mentioned or not all fixtures and appliances shall be provided with all fixing devices, nuts, bolts, and screws, hangers as required.

General Requirements

- dlxxxiii. All fixtures and fittings shall be provided with all such accessories as are required to complete the item in working condition
- dlxxxiv. All fixtures and accessories shall be fixed in accordance with a set pattern matching the tiles of interior finish. Whether necessary the fittings shall be centered to dimensions and pattern desired.
- dlxxxv. Fixing screws shall be half round head chromium plated brass with C.P. washers wherever required as per direction of the Project Manager/appropriate government authority appointed by GSCDL.
- dlxxxvi. All fittings and fixtures shall be fixed in a neat workmanlike manner true to levels and heights and in accordance with the manufacturer's recommendations. Care shall be taken to fix all inlet and outlet pipes at correct positions. Faulty locations shall be made good and any damage to the finished floor, tiling or terrace shall be made good by the Contractor.

tttttt) When directed the Contractor shall install fixtures and accessories in a mock-up room for the approval of the Project Manager/appropriate government authority appointed by GSCDL. Sample room fixtures may be reused on the works if undamaged.

Towel Ring

Towel ring shall be of Brass C.P. with circular flanges. The size of the ring shall be 150 mm dia. The bracket shall be fixed by means of CP brass screws & Fischer plugs firmly embedded in the wall.

Toilet Paper Holder and Soap Tray

All that items above shall be measured in numbers and the quoted rate shall be for 50% color vitreous China.

Mode of Measurement

All the items above shall be measured in numbers and the quoted rate shall be per number only which shall include unless otherwise specified:

- dlxxxvii. The cost of respective materials
- dlxxxviii. Necessary fixtures
- dlxxxix. Fixing in position
- dx. And testing where necessary/specified.

Urinal Partitions

Urinal partitions shall be white glazed vitreous china or 25mm thick marble of size. Porcelain partitions shall be fixed at proper height with C.P. brass bolts, anchor fasteners and M.S. clip as recommended by the manufacturer and directed by the Project Manager/appropriate government authority appointed by GSCDL.

Indian W.C.

- dxci. Indian W.C. pan shall be Orissa pattern of size. Each WC shall be provided with a 100 mm diameter cast iron of porcelain 'P' or 'S' traps with or without vent horn.
- dxcii. W.C. shall be flushed by means of a C.I. high level flushing cistern or low-level cistern of polyethylene body complete with accessories or with 32 mm diameter C.P. flush valve.

Anglo Indian W.C.

- dxci. Anglo Indian W.C. shall be wash down type 'P' or 'S' trap set.
- dxci. Each Anglo Indian W.C. set shall be provided with a solid plastic seat, rubbers buffers and chromium-plated hinges.
- dxci. Plastic seat shall be so fixed that it remains absolutely stationery in vertical position without falling down on the W.C.
- dxci. Each Anglo Indian W.C. shall be flushed with porcelain flushing cistern or an exposed or concealed type flush valve. Flush pipe/bend shall be connected to the W.C. by means of a suitable rubber adapter. 25 % of total W.C are Indian W.C

European W.C.

- dxci. European W.C. shall be wash down single or double siphonic type floor or wall mounted and flushed by means of porcelain low level flushing cistern or the exposed or concealed type flush valve. Flush pipe/bend shall be connected to the W.C. by means of suitable rubber adapter. Wall hung W.C. shall be supported by C.I. floor mounted chair. 50 % of total W.C are Indian W.C
- dxci. Each W.C. seat shall be so fixed that it remains absolutely stationery in vertical position without falling down on the W.C.

Lavatory Basin

- dxci. Lavatory basins shall be white glazed vitreous china or poly marble of size, shape and type specified in the bill of quantities.
 - dc. Each basin shall be provided with R.S. or C.I. bracket and clips and the basin securely fixed to wall. Placing of basins over the brackets without secure fixing shall not be accepted.
 - dc. Each basin shall be provided with 32mm diameter C.P. brass bottle trap with C.P. pipe to wall and flame.
 - dc. Each basin shall be provided with fittings or mixing fittings.
 - dc. Basins shall be fixed at proper heights.

Sinks

- dc. Sinks shall be of stainless steel.
- dc. Each sink shall be provided with R.S. or C.I. brackets and clips and securely fixed.
- dc. Counter top sinks shall be fixed with suitable angle iron clips or brackets as recommended by the manufacturer. Each sink shall be provided with 40mm diameter C.P.

waste with chain and plug or P.V.C. waste. Fixing shall be done as directed by the Project Manager/appropriate government authority appointed by GSCDL.

- dcvii. Fittings for supply to sinks shall be C.P. brass single hole mixing fitting with swinging spout for hot and cold water and C.P. brass swan neck tap swinging spout for cold water supply.

Mirrors

- dcviii. Mirrors shall be electro coated copper 5.5 mm thick of guaranteed reputed make.
dcix. The image shall be clear and without waviness at all angles of vision.
dcx. Mirrors shall be provided with backing of 12 mm thick 6mm thick cement asbestos sheet fixed with C.P. brass semi round- headed screws and cup washers or C.P. brass clamps as specified or instructed by the Project Manager/appropriate government authority appointed by GSCDL.

Shower set

- dcxi. Shower set shall comprise of one/two C.P. brass concealed stop cocks with two long body brass/C.P. brass bid cock, or bath spout.
dcxii. Each shower set shall also be provided with C.P. shower arm with wall flange and showerhead of approved quality.
dcxiii. Concealed stop cocks shall be so fixed as to keep the wall flange clear off the finished wall. Wall flanges embedded in the finishing of wall shall not be accepted.

Accessories

- dcxiv. The Contractor shall install all chromium plated and porcelain accessories or as directed by the Project Manager/appropriate government authority appointed by GSCDL.
dcxv. All C.P. accessories shall be fixed with C.P. brass half round head screws and cup washers in wall with raw plugs or nylon sleeves and shall include cutting and making good as required or directed by the Project Manager/appropriate government authority appointed by GSCDL.
dcxvi. Porcelain accessories shall be fixed in walls and set in cement mortar 1:2 (1 cement:2 coarse sand) and fixed in relation to the tiling work.

Specifications of Work

Internal Civil Works

- dcxvii. Earth excavation embankments & cuttings: Making up of plinths shall be carried out as per Sikkim PWD Specifications. Source of soil for filling purposes shall have to be got approved from the Project Manager/appropriate government authority appointed by GSCDL of work.
- dcxviii. Compaction of Earth work: Compaction of earthwork shall be carried out as per Sikkim PWD Specifications. Earthwork excavation of foundations and filling of trenches and filling under floors as per Sikkim PWD Specifications.
- dcxix. Demolition: Demolition, if any involves shall be carried out as per Sikkim PWD Specifications. Disposed- nothing shall be paid for disposal of non-perishable material. Perishable material shall be handed over to Authority.
- dcxx. Centering and Shuttering: Centering and shuttering shall be carried out as per Sikkim PWD Specifications.
- dcxxi. Cement concrete for Ordinary structures: Cement concrete for ordinary structures shall be executed as per Sikkim PWD Specifications.
- dcxxii. Reinforced concrete: For all works in super structure/ foundation 1:1.5:3 nominal mix by volume shall be used for achieving strength of M20 concrete. Only crushed coarse aggregates shall be used for concreting. Steel shall be high yield strength deformed bars conforming to IS – 1786 or TMT steel.
- dcxxiii. DPC: Item of D.P.C. shall be executed as per Sikkim PWD Specifications. DPC shall be with conformity to I.S.3067 / I.S.1346.
- dcxxiv. Precast Lintels: All lintels upto 7' in length in masonry work over doors and windows shall not be laid Cast-in-Situ but shall be precasted as per instruction of the Project Manager/appropriate government authority appointed by GSCDL and shall be hoisted and placed at appropriate level, during masonry work, lintels beyond 4'-6" length shall be laid in situ. Lintels will be casted over a *pucca* platform, and shall be cured for at least 10 days in a tank built at site and be dried completely before placing.
- dcxxv. Brick Masonry: Wherever the brick masonry shall involve in the execution of work, the same shall be carried out as per Sikkim PWD Specifications. All the instructions regarding workmanship such as bond and laying, joints straightness, face work raking of joints and scaffolding etc. shall be followed as per the Sikkim PWD Specifications. The masonry shall be carried out in the cement mortar. Corbelling, Coping and Cornices shall be executed as per specifications. 4 1/2" and 3" thick masonry partition walls. Partition walls shall be constructed as per Sikkim PWD Specifications. C.R. Masonry shall be with conformity to I.S.1597. Brick masonry shall be with conformity to I.S.2212. Cement plastering shall be with conformity to I.S.9103 & 6925. Mortar shall be with conformity to I.S.2250. White and color washing shall be with conformity to I.S.6278.
- dcxxvi. Cupboard Shutters: Cupboard shutters shall be wooden as per Sikkim PWD building Specifications.

- dcxxvii. Door Shutters: All door shutters shall be 40 mm thick wooden with 12 mm thick panels of waterproof as per Sikkim PWD building Specifications. Also following standards shall confirm to for Steel Window Frame I.S. 1038/83 and Steel Door Frame I.S. 4351/75
- dcxxviii. Windows Shutters: Window shutters shall be 35 mm thick of wooden having glass panes as per Sikkim PWD building Specifications. Wire gauge shutters should be provided wherever required.
- dcxxix. Aluminum Window: Providing & fixing of DOMAL - 40 Aluminum Building Systems, made from 6063 T-6 alloy and tempered euro groove aluminum profile, in approved surface coating, mechanically mitered & jointed with corrosion resistance DOMAL accessories and hardware. Glass infill, of desired thickness, shall be fixed onto using non-aging siliconized microwave treated DOMAL gaskets depending upon on the structural conditions, functions and statistical load requirements.
- dcxxx. Wire gauge Shutters: Wire gauge shutters shall be as per Sikkim PWD building Specifications.
- dcxxxi. Doors, Windows and Shutters Other than Wooden
- dcxxxii. Cement Concrete Road works: Latest edition of IRC and MoRTH specifications shall be followed for road works.

Note: For road work (Approach Road) specification as per road and bridges (latest edition) published by I.R.C & M.O.S.T. shall be follow ed. In case of any doubt and absence of provision, regarding specification I.S. shall be referred (Indian standard).

- dcxxxiii. Expansion Joints: Expansion Joints shall be provided in the buildings wherever required. Construction joints shall confirm to I.S. 3414. The conditions for providing expansion joints are as under:

uuuuuuu) Where the length of the building blocks exceed 50 meters.

vvvvvvv) All the components such as ramps stain links of corridors with the main building.

wwwwwww) In case of provision for horizontal further expansion be provided.

xxxxxxx) In case of level difference exceeding 1.8 mts.

Type of expansion joints: In case of larger blocks framed shutters, only double column, double beam expansion joints shall be provided:

yyyyyyy) In case of masonry blocks double beam expansion joints will be provided along with expansion joints on walls.

zzzzzzz) In case of connecting link corridors cantilever type of expansion joints will be provided. These joints shall be maintained in the flooring itself preferably or will be covered with 300 mm wide separate piece of flooring material specified.

Expansion Joints in the wall shall be covered from inside with 14 gauge aluminum sheet 150 mm wide fixed with appropriate fastener on one side of the wall. In no case bracket type expansion joints will be provided.

External Civil Works

- dcxxxiv. Parking Area: Covered area with interlocking pavers shall be as per Sikkim PWD Specifications.
- dcxxxv. M.S. Gates: M.S. Gates shall be as per Sikkim PWD Specifications.
- dcxxxvi. Boundary Wall: Boundary wall around the SOCIAL HOUSING FOR EWS shall be 1.8m high, constructed in first class brick masonry.
- dcxxxvii. Kerb & Channels: Kerbs & channels wherever provided along the roadside shall conform to relevant Sikkim PWD Specifications.
- dcxxxviii. Jungle Clearance: Clearing of weeds, shrubs, brushwood and congress grass under this item shall be removed by roots. Tree shall not be cut. The item shall be executed as per Sikkim PWD Specifications.
- dcxxxix. Subgrade of Internal Roads: The top 2' portion of embankment in the complete formation width of the internal roads, which is sub grade of the road, shall consist of sandy soils. A1, A2 and A3 type soils as per PRA classification conforming to latest IRC specification shall be only allowed in sub grade. Silty & clayey soil, which make weak sub grade & have no self-drainage shall not be permitted for use.
- dcxl.** Stone Metal 60-11.2 mm: Crushed stone metal of Sikkim government approved quarries shall be only used for construction for roads. It should be angular and drawn from hard durable tough stones of uniform texture. It should not absorb water more than 1% and its aggregate impact value should not be more than 30. The grading should confirm to MoRTH specification as given in table below:

Table 19: Grading of Crushed Stone Metal

Sieve Designation	Percent by weight passing
60 mm	100.00
53 mm	95-100
45 mm	65-90
22.4 mm	0-10
11.2 mm	0-5

- dcxli. Grit: The crushed aggregates for mix seal surfacing shall be blended in the requirement ratio or achieving the proper gradation as per MoRTH specification. The individual size of the grit should also be conforming to MoRTH, specification.

Technical Specifications – Public Health and Fire Fighting Works

General Technical Conditions and Scope of Work

- dcxlii. Work under this section shall consist of furnishing all materials, equipment and applicable necessary and required to completely furnish all the plumbing and other specialized services as described herein.
- dcxliii. Without restricting to the generality of the foregoing the sanitary fixtures shall include the following:
- | | |
|------------|---|
| aaaaaaaa) | Sanitary Fixtures |
| bbbbbbbbb) | Soil, waste, rainwater and vent pipes Water supply (internal and external) External sewerage system |
| cccccccc) | Storm water drainage system |
- dcxliv. The Contractor must get acquainted with the proposed site for the works and study specifications carefully.
- dcxlv. Works area shall be as per finalized and approved drawings from the Project Manager/appropriate government authority appointed by GSCDL.

Specifications

- dcxli. Work under this section shall be carried out strictly in accordance with specifications.
- dcxlvii. Items not covered under these specifications due to any ambiguity or misprints, or additional works, the work shall be carried out as per the Sikkim PWD Specifications.
- dcxlviii. Works not covered above shall be carried out as per relevant Indian Standards specifications or codes of practice or as per directions of Authority.

Execution of Work

- dcxlix. The work shall be carried out in conformity with Architectural, HVAC, Electrical, plumbing, Structural, and other specialized services.
- dcl. The Contractor shall make provision for hangers, sleeves, structural openings and other requirements well in advance to prevent hold up of progress of construction programme.
- dcli.** On award of the concession, the Contractor shall submit a programme of construction in the form of a PERT chart or bar chart for approval of the Project Manager/appropriate government authority appointed by GSCDL. All the dates and time Chapter agreed upon shall be strictly adhered to, within the stipulated time of completion / commissioning along with the specified phasing, if any.

Drawings

- dclii. Plumbing drawings would be diagrammatic and shall be followed as closely as actual construction permits. Any deviations made shall be in conformity with the Architectural drawings.
- dcliii. Architectural drawings shall take precedence over plumbing or other services drawings as to all dimensions.
- dcliv. Contractor's shall verify all dimensions at site and bring to the notice of the Project Manager/appropriate government authority appointed by GSCDL of works all discrepancies or deviations noticed. The Project Manager/appropriate government authority appointed by GSCDL decision shall be final.
- dclv. Large size details and manufacturers dimension for materials to be incorporated shall take precedence over small-scale drawings.

Inspection and testing of materials

- dclvi. The Contractor shall be required, if requested to produce the manufacturers' test certificate for the particular batch of materials supplied by him. The test carried out shall be as per the relevant Indian Standards.
- dclvii. For examination and testing of materials and works at the site the Contractor shall provide all testing and gauging equipments necessary but not limited to the following:

- ddddddd) Theodolite
- eeeeeee) Dumpy level
- ffffff) Steel tapes
- ggggggg) Weighing machine
- hhhhhhh) Plumb bob, Spirit levels, Hammers
- iiiiiii) Micrometers
- jjjjjjj) Thermometers, Stoves
- kkkkkkk) Hydraulic test machine
- lllllll) Smoke test machine

All such equipment shall be tested for calibration at any approved laboratory, if required by the Project Manager/appropriate government authority appointed by GSCDL.

- dclviii. All testing equipment shall be preferably located in special room meant for the purpose.

Metric conversion

- dclix. All dimensions and sizes of materials and equipment given in the specifications are commercial metric sizes.
- dclx. Any weights or sizes given in the specification having changed due to metric conversion, the nearest equivalents sizes accepted by Indian Standards shall be acceptable without any additional cost.

Reference points

- dclxi. The Contractor shall provide permanent benchmarks, flag tops and other reference points for the proper execution of work and these shall be preserved till the end of the work.

- dclxii. All such reference points shall be in relation to the levels and locations given in the Architectural and plumbing drawings (to be detailed out by the Contractor).

Reference Drawings

- dclxiii. The Contractor shall maintain one set of all drawings issued to him as reference drawings. These shall not be used on site.
- dclxiv. All corrections, deviations and changes made on the site shall be shown on these reference drawings for final incorporation in the completion drawings. All changes to be made shall be initiated by the Project Manager/appropriate government authority appointed by GSCDL. These will then form the –As-Built Drawings.

Shop Drawings

- dclxv. The Contractor shall submit to the Project Manager/appropriate government authority appointed by GSCDL four copies of the shop drawings. Shop drawings shall be submitted under following conditions:

- mmmmmmmm) Showing any changes in layout in the plumbing drawings
- nnnnnnnn) Equipment layout and piping, wiring diagram
- oooooo) Manufacturer's or Contractor's fabrication drawings for any materials or equipment supplied by them.

- dclxvi. The Contractor shall submit four copies of catalogues, manufacturer's drawings. Equipment characteristic data or performances charts as required by the Project Manager/appropriate government authority appointed by GSCDL.

Completion Drawings

- dclxvii. On completions of work the Contractor shall submit one complete sets of original tracings and two prints of –as built drawings to the employer / Project manager/ appropriate government authority appointed by GSCDL. These drawings shall have the following information:

- pppppppp) Run of all piping and diameters on all floors and vertical stacks.
- qqqqqqqq) Ground and invert levels of all drainage pipes together with location of all manholes and connections upto outfall
- rrrrrrrr) Run of all water supply lines with diameters, locations, of control valves, access panels
- ssssssss) Locations of all mechanical equipment with layout and piping connections.

- dclxviii. The Contractor shall provide four sets of catalogues performances data and list of spare parts together with the name and address of the manufacturer for all electrical and mechanical equipment provided by him.

Testing

- dclxix. Piping and drainage works shall be tested as specified under the relevant clauses of the specifications.
- dclxx. Tests shall be performed in the presence of the Project Manager/appropriate government authority appointed by GSCDL.
- dclxxi. All materials and equipments found defective shall be replaced and whole work tested to meet the requirements of the specifications.
- dclxxii. The Contractor shall perform all such tests as may be necessary and required by the local authorities to meet Municipal or other bye-laws in force.

The Contractor shall provide all labour, equipment and materials for the performances of the tests.

Site Clearance and Clean up

- dclxxiii. The Contractor shall, from time to time clear away all debris and excess materials accumulated at the site
- dclxxiv. After the fixtures, equipments and appliances have been installed and commissioned, the Contractor shall clean up the same and remove all plaster, paints, stains, stickers and other foreign matter of discoloration leaving the same in a ready to use condition
- dclxxv. On completion of all works, the Contractor shall demolish all stores, remove all surplus materials and leave the site in a broom clean condition

License and Permit

- dclxxvi. The Contractor must hold a valid plumbing licenses issued by the Municipal Authority or other Government Agency under whose jurisdiction the work falls
- dclxxvii. The Contractor must keep constant liaison with the Government Agency and obtain approval of all drainage and water supply works carried out by him.
- dclxxviii. The Contractor shall obtain, from the Government Agency certificates with respect to his work as required for occupation of the building.
- dclxxix. All inspection fees or submission fees should be paid by the Contractor.

Cutting and Making good

No structural member shall be chased or cut without the written permission of the Project Manager/appropriate government authority appointed by GSCDL.

Materials

- dclxxx. All materials used in the works shall conform to the tender specification.
- dclxxxi. As far as possible materials bearing BIS certification marks shall be used with the approval of the Project Manager/appropriate government authority appointed by GSCDL.
- dclxxxii. Unless otherwise specified and expressly approved in writing by the Project Manager/appropriate government authority appointed by GSCDL, materials of makes and specifications mentioned with technical specification shall be used.

Mock up

- dclxxxiii. The Contractor shall install all pipes, fixtures, clamps and accessories and fixing devices in mock up shaft and room so constructed as directed by the Project Manager/appropriate government authority appointed by GSCDL without any cost. The materials used in the mock up may be reused in the works if found undamaged.
- dclxxxiv. Any tiles or finished surfaces or floors damaged by the Contractor while doing his work shall be made good with new tiles or other finishing material.

Technical Specifications – Fire Hydrant System

Scope of work

Work under this section shall consist of furnishing all labour, materials, equipment and appliances necessary and required to completely install wet. Riser fire system as required by the drawings and specified hereinafter or given in this Chapter of quantities. Without restricting to the generally of the foregoing, the fire hydrant system shall include the following:

- dclxxxv. Black steel mains including valves, hydrants and appurtenances.
- dclxxxvi. Black steel pipe fire risers within the building
- dclxxxvii. Landing valves, canvas hose pipes, hose reels, hose cabinets, fire brigade connections to pumps, appliances and pressure reducing devices.
- dclxxxviii. Excavation, anchor blocks and valve chamber.

General Requirements

All materials shall be of the best quality conforming to the specifications and subject to the approval of the Project manager/ appropriate government authority appointed by GSCDL. Pipes and fittings shall be fixed truly vertical, horizontal or in slopes as required in a neat workmanlike manner.

Pipes shall be fixed in a manner as to provide easy accessibility for repair and maintenance and shall not cause obstruction in shafts passages, etc. Pipes shall be securely fixed to walls and ceilings by suitable clamps at intervals specified. Only approved type of anchor fasteners shall be used for R.C.C. ceilings and walls. Valves and other appurtenances shall be so located that they are easily accessible for operations, repairs and maintenance.

Pipes and fittings for Internal Work

Jointing

M.S. Pipes: Pipes 50 mm diameter, and below shall be provided with metal to metal tapered threaded joints. Red lead shall be used for lubrication and rust prevention.

Pipes 65 mm diameter and above shall be provided with electrical resistance welding, jointing shall be butt welded between pipe and fittings.

Joints between C.I and M.S. pipe shall be made by providing a suitable flanged tail or sockets piece and M.S. flanges on the M.S. pipe shall have appropriate number of holes and shall be fastened with nuts, bolts and 3 mm thick compressed asbestos gaskets.

Excavation

Excavation for pipe lines shall be open trenches to levels and grades shown on the drawings or as required at site Pipe lines shall be buried to a minimum depth of 1 to 1.5 meter or as shown on the drawings:

- dclxxxix. Wherever required the Contractor shall support all trenches or adjoining structures with adequate timber supports.
- dcxc. On completion of testing and painting, trenches shall be refilled with excavated earth in 15 cm layers and consolidated.
- dcxci. Contractor shall dispose of all surplus earth within a lead of 200 meter or as directed by the Project Manager/appropriate government authority appointed by GSCDL.

Anchor blocks

The Contractor shall provide suitable cement concrete anchor blocks of ample dimensions at all bends, tee connections and other places required and necessary for overcoming pressure thrusts in pipes. Anchor blocks shall be of cement concrete 1:2:4 mix (1 cement: 2 coarse sand: 4 stone aggregate 20 mm nominal gauge).

Valves

Sluice valves 80mm diameter and above diameter shall be cast iron double flanged solid wedge, outside screw non rising stem, yoke type bonnet and two piece gland construction. The valves shall have renewable screwed body seat rings. Flanges shall have raised faces and serrated face finish and shall conform to IS 780-1984. Check valves shall be cast iron double flanged conforming to IS: 5312-1975 with cast iron steel body 13% chrome steel disc, hang pin and body seat ring.

Fire hydrants external hydrants

The Contractor shall provide external hydrant. The hydrants shall be controlled by a cast iron sluice valve. Hydrants shall have instantaneous type 63 mm diameter outlets. The hydrants shall be of gunmetal and flange inlet and single outlet conforming to IS: 908-1975 with G.I. duct foot bend and flanged riser of required height to bring the hydrant to correct level above ground.

The Contractor shall provide for each external fire hydrant two nos. of 63 mm diameter. 15 meter long rubberized fabric linen hose pipe with gunmetal male and female instantaneous type couplings machine wound with G.I. wire (hose to IS: 636 type 2 and couplings to IS: 903 with IS: certification) gunmetal branch pipe with 16 mm nozzle to IS: 903.

Internal hydrants

The Contractor shall provide on each landing and other locations, one single headed gunmetal landing valve with 63 mm diameter outlets and 80 mm inlet (IS: 5290-1969) with individual shut off valves and cast iron wheels. Landing valves shall have flanged inlet and instantaneous type outlet. Instantaneous outlet for hydrants shall be of standard pattern approved and suitable for fire brigade hoses. The Contractor shall provide for each internal fire hydrant station four numbers of 63 mm id 15 meter long rubberized fabric linen hose pipes with G.I. wire (Hose to I.S. 636 type 2 and couplings to IS: 903 with IS: certification), fire hose reel, gunmetal branch pipe with nozzle IS: 903 and fireman's axe.

Each hose box shall be conspicuously painted with the letters —FIRE HOSEII.

Fire hose reels

The Contractor shall provide standard fire hose reels with 20 mm diameter high pressure rubber hose of 36.5 meter length with gunmetal nozzle with 5mm bore, and control valve, shut of nozzle

connected wall mounted on circular hose reel of heavy duty mild steel construction and cast iron brackets. Hose reel shall conform to IS: 884-1969. The hose reel shall be connected directly to the M.S pipe riser through an independent connection.

Orifice flanges

Provide orifice flanges fabricated from 6 mm thick stainless steel plate to reduce pressure on individual hydrants to restrict the operating pressure to 3.5 kg/sqmt. The design of the orifice flanges shall be given by the Contractor as per the location and pressure conditions of each hydrant/hose reel.

Fire brigade connection

Provide gunmetal two or four way collecting head with 63 mm diameter instantaneous type inlet with built in check valve and 100/150 mm diameter outlet connection to the fire main grid and for tank filling, collecting head shall conform to IS 904-1965.

Draw off connection

- dcxcii. Air valves
Provide 25 mm i/d. screwed inlet single acting brass air valve on all high points in the system on top of air cushion tanks.
- dcxciii. Drain valve
Provide 50 mm id. G.I. pipe to IS: 1239 (Medium class) with 50 mm gunmetal full way valve for draining any water in the system in low pockets as directed by the Project Manager/appropriate government authority appointed by GSCDL.
- dcxciv. Hydrant/Valve Chambers
The Contractor shall provide suitable brick masonry chambers in cement mortar 1:5 (1cement: 5 coarse sand) on cement concrete foundations 150 mm thick 1:4:8 mix (1 cement:4 fine sand:8 graded stone aggregate 40mm nominal size) 15 mm thick cement plaster inside and outside finished with a floating coat of neat cement, inside with cast iron surface box approved by fire brigade including excavation, back filling, complete Valve chamber shall be of the following size:

ttttttt) For depths 100cm and beyond 120x120 cms
uuuuuuuu) Weight of C.I. frame and cover shall be 38 kg.

Pipe protection

All pipes above ground and in exposed locations shall be painted with one coat of red- oxide primer and two or more coats of synthetic enamel paint of approved shade. All buried MS. Pipes shall be provided with protection against soil corrosion by applying two coats of coal tar hot enamel paint, two layers reinforced fiber glass tissue and finished with one coat of the above paint (as per IS: 10221)

Pipe support

All pipes shall be adequately supported from ceiling or walls from existing inserts by structural clamps fabricated from M.S. Structural, e.g., rods, channels, angles and flats. All clamps shall be painted with one coat of red lead and two coats of black enamel paint.

Where inserts are not provided the Contractor shall provide anchor fasteners. Anchor fastener shall be fixed to walls and ceilings by drilling holes with electrical drill in an approved manner as recommended by the manufacturer of the fasteners.

Testing

All pipes in the system shall be tested to a hydrostatic pressure of 14.5 kg/sq.cm. without drop in pressure for at least 2 hours.

Hose cabinets

Provide hose cabinets for internal/ external hydrants fabricated from 16 gauge MS sheet with single or double glass front door and locking arrangement with breakable glass key access arrangement, duly painted red with stove enamelled paint fixed to wall or self-supported on floor as per site conditions. The cabinet shall also have a separate chamber to keep the key with breakable glass as per approved design. Hose cabinets shall be fabricated from 16 gauge MS sheet of fully welded construction with hinged double front door partially glazed with locking arrangement stove enamelled fire red paint with –FIRE HOSE written on it prominently. Samples of hose cabinet for internal and external works are not approved from the Project Manager/appropriate government authority appointed by GSCDL before installation at site.

Pumps and Ancillary Equipment for fire-fighting systems

Scope of work

Work under this section shall consist of furnishing all labour, materials, Equipment and appliances necessary and required to completely install electrically operated pumps for fire hydrant and sprinkler installations as specified hereinafter. Without restricting to the generality of the foregoing, the pumps and the ancillary equipment shall include the following:-

- dcxcv. Electrically operated pumps with motors, base plate and accessories Alarm system with all accessories wiring and connections.
- dcxcvi. Pumps suction and delivery headers, valves, air vessel & connections.
- dcxcvii. Pressure gauges.
- dcxcviii. Electrical switchboard, wiring, cabling, cable tray and earthing.

General requirements

Pumps shall be installed true level on suitable concrete foundations. Base Plate shall be firmly fixed by foundation bolts properly grouted in the concrete foundations. Pumps and motors shall be truly aligned by suitable instruments. All pumps connection shall be standard flanged type with appropriate number of bolts. Manufacturer's instructions regarding installation connections and commissioning shall be followed with respect to all pumps, switchgear and accessories.

Fire and jockey pumps

- dcxcix. Pumping Sets
Pumping sets shall be multistage horizontal centrifugal multi-stage outlet pumps with cast iron body and bronze dynamically balanced impeller connecting shaft shall be stainless steel. Pumps shall be connected to drive by means of a flexible coupling with sheet metal guard. Pumps shall be provided with approved type of mechanical seals and pressure gauge with isolation cock on the delivery side.
Pumps shall be capable of furnishing not less than 150% of the rated capacity at a head of not less than 65 % of the rated head. The shut off head shall not exceed 120% of the rated head.
- dcc. Wet Riser Hydrant and Sprinkler Systems
Wet riser hydrant and sprinkler shall be pressurized through a set of pumps driven by electric motors. Desired pressure shall be created and maintained in the systems by means of main and Jockey pump sets. The working of the pumps sets shall be as under:

vvvvvvv) Main pump for Hydrant and Sprinkler systems.

wwwwwww) Automatic start on reduction in the pressure in the system at predetermined level.

Also manual start arrangement shall be made in case of failure of automatic start system. Pump set shall stop by manual operation only.

- dccl. Stand by main pump (Diesel Engine Driven)
In the event of failure in the operation of main pump sets for hydrants and sprinklers, the standby main pump shall come into operation when the pressure in the system is reduced to a pre-determined level. Also manual start arrangement shall be made in case of failure of automatic start arrangements. Pump set shall stop by manual operation only.
- dccli. Jockey Pump
Starting and stopping of Jockey pump set shall be automatic at pre-determined levels. However, arrangements for manual start and stop of the pump shall also be made. Jockey pump shall take care of small leakages in the piping system and pumps cushion tanks.

Electric Drive

Electrically driven pumps shall be provided with totally enclosed induction motors suitable for fire pumps. The motors should be rated not to draw more than 4.5 times the starting current. Motors shall be at least equivalent to the horse power required to drive the pump at 150% of its rated discharge. The motors shall be wound for class E insulation and windings shall be vacuum impregnated with heat and moisture resisting varnish, glass fibre insulated.

Diesel Engine

Diesel Engine shall be of suitable HP with individual heat assemblies. The engine shall be water-cooled and shall include heat exchanger and connecting piping strainer isolating and pressure reducing valves, by-pass line complete in all respects. The Engine shall be of direct injection type with low noise and exhaust emission levels. The speed of engine shall match the pump speed for direct drive.

The engine shall be capable of being started without the use of the wicks, cartridge heater plugs or either at engine room temperature of 7 degree C. and shall take full load within 15 seconds from the receipt of the signal to start. The engine shall effectively operate at 38 degree C. ambient temperature at 150 meters above mean sea level. Noise level of the engine shall not exceed 105 db. (free field sound pressure) at 3 meters distance. The engine shall be self-starting type up to 4 deg. C shall be provided with one 24 volts heavy duty D.C. battery, star term cut-out, battery leads complete in all respects. One additional spare battery shall be provided. The battery shall have a capacity of 200 ampere hours and 640 amperes cold cranking amperage. Provide a battery charger of 10 to 15 amperes capacity with trickle and booster charging facility and regulators. Arrangement for starting shall be automatic on receiving the signal. But shut off shall be manual. The engine shall be provided with an oil bath or dry type air cleaner as per manufacturer's design. Engine shall be suitable for running on high speed diesel oil. The system shall be provided with a control panel with push button starting. Arrangement also wired to operate the engine on a differential pressure gauge.

The entire system shall be mounted on a common structural base plate with anti-vibration mounting, Dunlop make, and flexible connections on the suction and delivery piping. Provide one fully mounted and supported day oil tank fabricated from 6 mm thick MS sheet electrically welded of 8 hours working load but not less than 200 liters. Provide level indicators- low level and fill level in the day oil tank on the control panel through float switches and an air breather. Provide on exhaust pipe with suitable muffler (resident type) to discharge the engine gases to outside in open air as per site conditions (Contractor to check the site). Provide all accessories, fittings, and fixtures necessary and required for a complete operating engine set. The exhaust pipe shall be taken outside the Building with a number of bends (approx. length 20 meters.) and shall be duly

heat insulated with rain cover. The Contractor shall indicate special requirement, if any, for the ventilation of the pump room.

Base Plate

Pumps and motors shall be mounted on a common structural base plate with anti- vibration mounting.

Air Vessel

Provide one air vessel fabricated from 12 mm M.S. plate with dished ends & suitable supporting legs. Each air vessel shall be provided with a 100 mm diameter flanged connection from pump, one 25 mm diameter. drain with valve, one gunmetal water level gauge and 25 mm sockets for pressure switches. The vessel shall be 450 mm diameter x 2000 mm high and tested to 28 kg / sqcm pressure.

The fire pumps shall operate on drop of 1 kg / sqcm pressure in the mains. The pump operating sequence shall be arranged in a manner to start the pumps automatically but should be stopped by starter push buttons only.

Vibration eliminators

Provide on all suction and delivery lines double-flanged reinforced neoprene flexible pipe connectors. Connectors should be suitable for a working pressure of each pump and tested to the test pressure give in the relevant heat. Length of the test connector shall be as per manufacturer details.

Switchboard cubicle

Provide and install one switch board cubicle of approved dust and vermin proof type fabricated from 16 gauge M.S. sheet and finished with synthetic enamel paint of approved shade and shall have plastic identification for different motors. The cubicle shall comprise of the following:-

- dcciii. Aluminum bus bar of rated capacity in a separate chamber with two additional share chambers.
- dcciv. Incoming main isolation switch fuse unit of required capacity HRC fuses.
- dccv. Isolation switch fuse unit of required capacity HRC fuses, one for each motor.
- dccvi. Fully automatic auto transformer starters with push buttons one for each motor.
- dccvii. Fully automatic —STAR DELTA starters with push buttons for jockey pumps.
- dccviii. Single phasing prevention for suitable rating for each motor.
- dccix. Panel type ampere meters, one for each motor.
- dccx. Panel type volt meter on incoming main with rotary selector switch to read voltage between phase to neutral and phase to phase.
- dccxi. Three neon phase indicating lamps on incoming main.
- dccxii. Two rotary switches for manual/ auto operations of fire and sprinkler pumps.
- dccxiii. All interconnecting colour coded wiring from incoming main to switch gear, meters and accessories within the switchboard panel.
All switchgears and accessories shall be of approved make such as SIEMENS, ENGLISH ELECTRIC, LARSEN AND TOUBRO or approved equivalent as approved

by the Project Manager/appropriate government authority appointed by GSCDL. Switchboard cubicles shall be floor-mounted type.

Cables

The Contractor shall provide all power and control cables from the motor control centre to various motors and control devices. Cables should conform to IS: 1554 and carry BIS certification mark. Wiring cables should conform to IS: 694. All power and wiring cables shall be aluminum conductors PVC insulated armoured and PVC sheathed of 1.1 KW grade. All control cables shall have stranded conductors. The cables shall be supplied in drums as far as possible and bear the manufacturer's identification mark. All cable joints shall be made in an approved manner as per accepted practice.

Earthing

There shall be two independent earthing stations at least 3 meters away from the pump room. The earthing shall consist of an earth tape connected to an independent plate made of C.I. having a conductivity of not less than 100% international standard. All electrical apparatus, cable boxes and sheath/ armour clamps shall be connected to the main bar by means of branch earth connections of appropriate size. All joints in the main bar and branch bar shall have the lapping surface properly tinned to prevent oxidation. The joints shall be riveted and sweated.

Earth plates shall be buried in a pit 1.2 x 1.2 meter a minimum depth of 3 meter below the ground. The connections between the main bars shall be made by means of three 10 mm brass studs and fixed at 100 mm centres. The pit shall filled with coke breeze, rock salt and loose soil. A.G.I.Pipe of 20mm i/d. with perforation on the periphery shall be placed vertically over the plate to reach ground level for watering. A brick masonry manhole 30 x 30 x 30 cm. size shall be provided to surround the pipe for inspection. A bolted removable link connecting main bar outside the pit portion leading to the plate shall be accommodated in this manhole for testing.

Commissioning

Commissioning of the systems shall commence only after:

- dccxiv. All pipes, accessories, pumping set, fire alarms, etc., have been completely installed and tested.
- dccxv. The electrical connection has been made & direction of motors rotation checked. (c) Related works by other agencies has been completed in all respects.
- dccxvi. Water supply is available in adequate quantity in the underground tank. (e) Basement drainage pumps are fully commissioned.
- dccxvii. On completion of all related work given in para above, start pumping sets and develop desired pressures in both the systems.
- dccxviii. Open one hydrant and test if pump starts at desired drop in pressure and the alarm operates. If required make adjustments and retest.

Maintenance manual

On completion of the entire work and successful commissioning, the Contractor shall hand over four copies of maintenance manuals of all equipment installed by him. Maintenance manuals shall include information relating to make, model No. year of manufacture for all electrical and mechanical equipments with names of local supplies or manufacturers' agents.

Commissioning for Fire-fighting System

Scope of Work

Work under this section shall consist of pre commissioning, commissioning, testing and providing guarantees for all equipments, appliances and accessories supplied and installed by the Contractor under this contract.

General Requirements

The Contractor shall provide all tools, equipments, metering and testing devices required for the purpose.

On award of concession, the Contractor shall submit a detailed proposal giving methods of testing and gauging the performance of the equipment to be supplied and installed under this contract.

Pre-commissioning

On completion the installation of all pumps, piping, valves, pipe connections, electrical wiring, motor control panels and water level controlling devices the Contractor shall proceed as follows:

Testing of M.C.C.

- dccxix. Insulation resistance test with 500 volt megger, before and after high voltage test, on all power and control wiring.
- dccxx. High voltage test at 2000 volts A.C. for one minute on all power and control wiring.
- dccxxi. Low voltage continuity test (t volts) on power wiring of each feeder, between bust bars and outgoing terminals with switches and conductors in closed position.
- dccxxii. Low voltage continuity test (6 volts) on all control wiring.
- dccxxiii. Operation test for all feelers with only control supply made –ONII to ensure correctness of control wiring, operation of the various equipment used, such as push buttons, protective devices, indicating lamps and relays, etc. All conductors shall be checked for the presence of humming and chattering.
- dccxxiv. Earth continuity test with voltage not exceeding 6 volts between various non- current carrying metallic of equipment, steel work, etc., and the earth bus provided in the M.C.C.
- dccxxv. Operation of all instruments and meters provided on the M.C.C.

Fire Protection System

- dccxxvi. Check all hydrant valves and if any valve is open than close it. Check that all suction and delivery connections are properly made.
- dccxxvii. Tests run and check rotation of each motor and correct the same required.

Pipe Work

Check all clamps, support and hangers provided for the pipes. Fill up pipes with water and apply hydrostatic pressure to the systems as given in the specifications if any leakage is found. Rectify the same and retest the pipes.

Commissioning and Testing Fire Hydrant System

- dccxxviii. Pressurize the fire hydrant system by running the main fire pump and after attaining the required pressure shut off the pump.
- dccxxix. Open by-pass valve and allow the pressure to drop in the system. Check that the jockeys pump cuts-in and cuts-out at the preset pressures. If necessary adjust the pressure switch for the jockey pump. Close by-pass valve.
- dccxxx. Open hydrant valve and allow the water to flow into the fire water tank in order to avoid wastage of water. The main fire pump should cut-in the present pressure and should not cut-out automatically on reaching the normal line pressure. The main fire pump should stop only by manual push button. However, the jockey pumps should cut out as soon as the main pump starts.
- dccxxxi. Switch off the main fire pump and test check the diesel engine driven pump in the same manner as the electrically driven pump.
- dccxxxii. When the fire pumps have been checked for satisfactory working on automatic, open fire hydrant valves simultaneously and allow the hosepipes to discharge water into the fire tank to avoid wastages. The electrically driven pump should run continuously for eight hours so that its performance can be checked.
- dccxxxiii. Diesel engine driven pump should also be checked in the same manner as given above by running for 8 hours.
- dccxxxiv. Check each landing valve, male and female coupling and branch pipes for compatibility with each other. The Contractor shall replace any fitting, which is found to be incompatible and does not fit into the other properly. Landing valves shall also be checked by opening and closing under pressure.

Handing Over

The Contractor to the complete satisfaction of the Project Manager/appropriate government authority appointed by GSCDL shall do all commissioning and testing. The Contractor shall also get the system approved from the local fire authorities and submit NOC received from the Fire Department /Authority.

Regulations, codes of practice, references and standards

The aspects of the design which are related to HSE must respect applicable Regulations, Codes of Practice and Standards. Those which are relevant to this project are listed below in order of priority. International codes and regulations shall be applied unless more stringent national rules exist. In case of conflict, priority shall be given according to the following list:

- | | |
|-----------|------------------------------------|
| xxxxxxx) | National Regulations, |
| yyyyyyyy) | Manufacturers Standards, |
| zzzzzzzz) | International Codes and Standards. |

National regulations

The SOCIAL HOUSING FOR EWS project shall comply with the applicable International, National & State regulations.

Company standards

The design of project facility shall comply with the latest revisions of the State Safety Standards, Fire Brigade & International Codes, Specifications and design criteria as provided in the contract.

Technical Specifications – Installation of Tube well

- dccxxxv. Selection of site
The site where the Project manager/ appropriate government authority appointed by GSCDL wants to sink the tube well should be examined. Any previous data available with the Contractor, of the nearby areas should be made use to evolve suitable procedure for drilling, developing and testing etc.
- dccxxxvi. Drilling
The drilling shall be done in accordance with the specification contained in IS: 2800 Part_ I, 1979 and as described in Chapter of work
- dccxxxvii. Drilling time log book
As the drilling progresses, and accurate drilling time logbook shall be maintained by the Contractor, indicating time taken to drill every two meters of depth where there is change of strata. This log will enable interpretation regarding the nature of formation (hard, soft, unconsolidated etc.), which has a bearing of water fielding capacity of the formation
- dccxxxviii. Geological data
Samples of drill cuttings from different strata shall be collected at suitable intervals preferably at every two meters depth drilled or at closer intervals, if a change in strata is met with. After the drilling has reached sufficient depth all the samples of strata collected shall be got examined analyzed in a laboratory
- dccxxxix. Design and lowering of pipe assembly
The design and diameter of the housing pipe shall be as specified in the Chapter of work. The size and length of blind pipes and slotted shall be in accordance with the requirements to the strata met with, the expected discharge and the depth of tube well. The design of the pipe assembly for stainer pipe and column pipe shall be submitted by the Contractor and approved by the Project Manager/appropriate government authority appointed by GSCDL
- dccxli. Gravel packing
All gravel shall consist of hard well-rounded particles reasonably uniform in diameter meter and shall be of a size given in the Chapter of work
- dccxlii. Developments of Tube well
The well shall be developed either by surging and agitating or by over pumping and back wash with an acceptable method may also be adopted with the consent of the Project Manager/appropriate government authority appointed by GSCDL. The development process shall be continued until the stabilization of sand and gravel pack has taken place. The development of the tube well by over pumping should be done at 15% to 25% higher discharge than the expected discharge from the tube well
- dccxliii. Grouting and sealing
Grouting and sealing of the tube may well be done, if required by the corporation depending upon the site conditions and quality of the discharge of the strata encountered. It should be applied in one continuous operation. Sealing of the tube well may be done by

grouting angular space between bore and the housing pipe, thickness of grouting depending upon the quality of water

dccxlili. Handing over of the Tube well

The tube-well should be handed over to the Project manager/ appropriate government authority appointed by GSCDL in complete shape and closed by a well cap for the period between the completions of tube well and the installation of the pump set. The following information should be furnished by the Contractor on completion of the tube well

aaaaaaaa) Strata chart of the tube well indicating different types of soil met with at different depth.

bbbbbbbbb) Samples of strata collected, neatly packed and correctly marked in sample bags/wooden box.

cccccccc) Chart of actual pipes assemble lowered indicating size of pipes, depth range where slotted/ strainer pipes, depth ranges, where slotted/ strainer pipes have been used, depth and diameter of housing pipe, reduced level of the top of the housing pipe and diameter and depth of the bore hole.

dddddddd) Geo hydro testing result of the borewell

eeeeeeee) Position of every joint in the well assembly.

fffffff) Hours of development done by compressed air, pump set or by other means.

gggggggg) Pumping water level at developed discharge

hhhhhhh) Report of the samples of water got tested in the approved laboratories

iiiiiii) Verticality and alignment As per IS: 2800(part- II) 1980

Electrical Installation Works

General

- dccxliv. Separate earth wire (Copper) will run for the light and power sockets
- dccxlv. The main switches and BDB's shall be connected with thimbles /lugs duly crimped with crimping tools.
- dccxlv. Only BIS mark or as per BIS copper cable should be used (as per list of approved makes attached) or approved equivalent as approved by the Project Manager/appropriate government authority appointed by GSCDL.
- dccxlvii. The cable and connections should be done to the switchgear by suitable size glands.
- dccxlviii. The insulation test, continuity test, earthlings test & other electrical installation tests will be done by the bidder in the presence of the Project Manager/appropriate government authority appointed by GSCDL at site work after the completion of the work
- dccclix. ELCB should be of approved makes as per list attached or approved equivalent as approved by the Project Manager/appropriate government authority appointed by GSCDL.
- dccli. The piano type accessories such as switches, sockets, ceiling roses etc., should be of BIS marked only.
- dccli. The fans should be of approved makes as per list attached.
- dccli. The fluorescent fitting, mirror optics fittings and street light fittings etc. should be of approved makes as per list attached.
- dccliii. The switch gear should be got approved from the Project Manager/appropriate government authority appointed by GSCDL of work before installation at site.
- dccliv. The junction box from where wires lead to BDB shall be at least 100mm deep & 150 mm high and long enough to accommodate the conduit pipe in a straight line.
- dcclv. The light plug shall be tapped from nearby power by means of 1.5 sq mm (1/1.80 mm) cable through 20mm diameter conduit pipe and max. 1 no. light plugs can be tapped from the power plug, where there is no power plug separate circuit with 2.5 sq.m. cable shall be drawn for feeding the supply to the light plugs.
- dcclvi. The Bakelite sheets to be provided should be of 3 mm thickness of makes HYLAM, FORMICA or any other make approved by the Project Manager/appropriate government authority appointed by GSCDL.
- dcclvii. Only BIS mark Batten Holders and Bakelite accessories shall be used or as approved by the Project Manager/appropriate government authority appointed by GSCDL.
- dcclviii. The work shall be carried out in strict accordance with the CPWD Specifications for electrical works in Government Buildings in the State and to the satisfaction of the Project Manager/appropriate government authority appointed by GSCDL.
- dcclix. The C.I./M.S. fan box for suspension hook should be of size 4.5" diameter, 4" deep and of 16 gauge with 0.5" diameter (Plain steel for suspension hook. The rod should be projected 6" on each side of the box or the design of the fan box shall be as approved by the Project Manager/appropriate government authority appointed by GSCDL.

- dcclx. The breaking up and making good of wall ceiling and floors shall be done by the Contractor at his own cost and to the entire satisfaction of the Project Manager/appropriate government authority appointed by GSCDL of the work. No extra payment will be made for the same.
- dcclxi. Looping in system, of wiring shall be adopted for all sub circuit wiring.
- dcclxii. The size of Branch Distribution Board (BDB) shall be designed on the basis of 8 points (light, fan,) and light plug connected tone way of BDB and in case of 10/Amp. power plug points, two power plugs are to be connected to one way of 32 Amp. BDB's or one point per way 16 Amp. BDB's. This practice should strictly be followed for connecting points to way of the BDB's.
- dcclxiii. The G.I. Pipe for earthing purpose, for protection of earth wires should be class 'A' water quality.
- dcclxiv. Before energizing the system the following tests shall be given by the Contractor so as to find out the installation to the relevant rules/regulations:-
- jjjjjjjj) Earth resistance test
 - kkkkkkkkk) Earth continuity test of conduit pipe or other iron clad system
etc.
 - lllllllll) Insulation test
 - mmmmmmmmm) Polarity test
- dcclxv. The control switch should not be installed at height less than 120 cm from floor level or as directed by the Project Manager/appropriate government authority appointed by GSCDL or as per site requirement.
- dcclxvi. The bodies of branch distribution fuse board should be machine made with 1.60 mm thick solid steel sheet.
- dcclxvii. Grip fuse units of sheet metal/iron clad, switch & branch distribution fuse boards should be of N.C. type so as to have the facility of interchange ability.
- dcclxviii. Brass screws to fix brown Bakelite/white glazed or translucent back side Painted sheet cover 3 mm thick. This should be fixed by means of flat headed brass machines screws with brass ring washers underneath.
- dcclxix. All conduit used in work shall be adequately bushed with P.V.C. bushes to prevent abrasion of insulation of conductor and shall also be bonded earth.
- dcclxx. The connection of earth wire with sheet metal/iron clad switch and branch distribution fuse boards or other metallic cases shall be according to the Indian Electricity Rules and made by means of suitable cable socket soldered at the end of earth wire.
- dcclxxi. Welded conduit pipe (Screw type) made from 1.60mm thick sheet coated with two coats of approved paint shall be used. The conduit pipe shall be joined by means of screwed sockets so that it shall be electrically continuous throughout. The threads shall be free from grease oil etc. and no material of nature should be allowed to come in contact with the conduit. Sharp edges or bare should not be allowed to remain due to which insulation of conduit pipe is likely to be damaged.
- dcclxxii. For the complete work of Electrical Installation, the Contractor shall provide circuit key diagram before the finalizing of bill for display at the important places in the Bus Terminal

as per the instructions of the Project Manager/appropriate government authority appointed by GSCDL.

- dcclxxiii. The electrical installation work shall be carried out in accordance with Indian Standard Code of practice for Electrical wiring installation IS: 732-1989 and IS: 2274-1963. It shall also be in conformity with the current Indian Electricity Rules & Regulations and Requirements of the local electricity supply authority and fire insurance regulation. Electrical work in general shall be carried out as per CPWD Specifications with upto date amendment.

Scope of Work

The scope of work shall cover internal and external electrical works for proposed bus stand. The items/activities covered under internal electrical works shall include the following:-

- dcclxxiv. Main Distribution Boards, Sub Distribution Boards. Switch fuse unit/MCB isolators etc. complete in all respect.
- dcclxxv. Cables from Main Distribution Board to Sub Distribution Boards. Sub main Wiring from Main/Sub Distribution Boards to various final Distribution Boards.
- dcclxxvi. Point wiring of all lights points. Ceiling fan points, exhaust fan points, light Plug points, general power points, metal clad plug & socket outlet points etc., including supply and fixing of light and power accessories etc. complete in all respects.
- dcclxxvii. Light fixtures, ceiling fans, exhaust fans.
- dcclxxviii. Provision for telephone system consisting of conduit and cabling from telephone distribution board upto each outlet including main & sub tag blocks, telephone outlets incoming GI/SW pipe etc. complete in all respect.
- dcclxxix. SW/GI pipes for cables, manholes, cable tray and other items required to complete with electrical installation work in all respects.
- dcclxxx. Earthing of electrical installation complete in all respects.
- dcclxxxi. Scope of work shall include supply installation, testing and commissioning of complete electrical installation as described above.
- dcclxxxii. Providing standby Power by installation of D.G. set of suitable capacity.
- dcclxxxiii. Sub-station work covering 11 KV Board, 11KV Cable, Transformer, LT Cable and main LT panel and Emergency panel etc.
- dcclxxxiv. External cabling from Substation to various blocks.
- dcclxxxv. Obtain NOC from Electrical Inspector for the Electrical Substation

Standard & Regulations

All equipment, switchgear, cables and other items of work shall conform to Indian Standard specifications

The installation shall conform in all respects to Indian Standards Code of Practice for Electrical Wiring Installation IS: 732-1989. It shall also be in conformity with the current Indian Electricity Rules and the Regulations and Requirements of the Local Electric Supply Authority, Local laws/by laws in so far as these become applicable to the installation. Wherever these specifications call for a higher standard of materials and/or workmanship than those required by any of the above regulations, these specifications shall take precedence over the said regulations and standard. In

general, the materials, equipment and workmanship shall conform to the following Indian Standards with up to date amendments/revisions if any unless otherwise called for.

Table 20: List of Approved Makes

Description	Specification	Makes	
a)Specification for DG Set 415V 3 Phase 4 wire, 50Hz	IS 4722-1992 BS 5514	Mahindra, Kirloskar, Cumminus, Ashok Layland or approved equivalent	
b)11 KV Vacuum Circuit Breaker	IS 3427-1991 IS 12729-1988	L & T, Siemens, Hager, ABB or approved equivalent	
c)Transformer 111 KV/0.433 KV	IS 2026-1977	Voltamp, BHEL, Kirloskar, Crompton Greeves or approved equivalent	
d)XLPE cable 11 KV	IS 7098 Part I &II 1988/1985	Polycab, Havells, Skytone, Paramount, CCI, Finolex or approved equivalent	
e)PVC insulated (heavy duty) electric cable Part I for voltage upto 1100 volt	IS 1554-1988	Polycab, Havells, Paramount, CCI, Finolex or approved equivalent	
f)Making arrangement for Switch gear Bus bars, main connection & auxiliary wiring	IS 375-1963	Havells, Indo Asian, L & T, Siemens, Hager, C & S or approved equivalent	
g)Specifications for normal duty air break switches & composite units for air break switches & fuses for voltage not exceeding 1000 volts	IS 13947-1993 (Part I to V)	Havells, Indo Asian, L & T, Siemens, Hager, C & S or approved equivalent	
h)Specification for low voltage switchgear & control gear assemblies.	IS 8623-1993 (Part I to III)	Havells, Indo Asian, L & T, Siemens, Hager, C & S or approved equivalent	
i) Specifications for enclosed distribution	IS 2675-1983	Havells, Indo Asian, L & T, Siemens, Hager, C & S or approved equivalent	
j) Installation & maintenance of Switchgear	IS 10118-1982 (Part I to IV)	Havells, Indo Asian, L & T, Siemens, Hager, C & S or approved equivalent	
k)HRC Fuses	IS 9224-1979	Havells, Indo Asian, L & T, Siemens, Hager, C & S or approved equivalent	
l) Specification for Rigid Steel conduits for electrical wiring	IS 9537-1981 (Part – II)	Nehir, Precision, Vraj, BEC, AKG or approved equivalent	
m)Specifications for accessories for rigid steel conduits for	IS 3837-1976	Nehir, Precision, Vraj, BEC, AKG	
	Description	Specification	Makes or approved equivalent
	electrical wiring		
n)	3 pin plugs & socket outlets	IS 1293-1988	Anchor, Hager, Cab tree, C & S, Havells, HPL Sudhir, Diamond, L&T Panels, Capitor Panels or approved equivalent
o)	General & Safety requirements for electric light fittings.	IS 1913-1978	---

Description	Specification	Makes
p) Electric ceiling fans & regulators	IS 374-1979	Havells, Crompton, Orient, Bajaj or approved equivalent
q) Code of practice for earthing	IS 3043-1987	Electrode Earth or approved equivalent
r) Current transformers	IS 2705 – 1992 (Part – I)	AE, Kappa, L&T or approved equivalent
s) Shunt capacitors for power system	IS 2834 – 2986	GE, ABB, or approved equivalent
t) Exhaust Chimney	IS 6533 – 1989 (Part– II)	Usha, Havells, Crompton, Bajaj, Almonard or approved equivalent
u) HSD Storage Tanks	IS 803/864	As per brand approved

Inspection and approval of the work by local authority on completion of this work. The Contractor shall obtain and deliver to the Project Manager/appropriate government authority appointed by GSCDL all the certificates of inspection and approval by the electrical inspectorate as required.

Panel, Main Distribution Boards / Sub distribution Boards

General

The scope covers supply, installation, testing and commissioning of power panels, incorporating circuit breakers, fuse units, bus bars, interconnections, earthing etc., meeting the requirements shown in equipment Chapter and the drawings. The Panel should be fabricated by CPRI approved panel builder only & should strictly follow all standards & code.

Main Distribution Board/ Sub Distribution Boards shall be metal clad totally enclosed, rigid, floor mounting, air insulated, cubicle type for use on 415 volts, 3 phase, 50 cycle system. System shall be suitable for a fault withstand capacity of 50 KA RMS, symmetrical equipment shall be designed for operation in high ambient temperature and high humidity tropical atmospheric conditions.

Standards

dcclxxxvi. The equipment shall be designed to conform to the requirement of:

- nnnnnnnn) IS-8623 – Factory Built Assemblies of switchgear and control gear
- oooooooo) IS-4237 – General requirements for switchgear and control gear for Voltages and exceeding 1000 volts.
- pppppppp) IS-2147 – Degree of Protection provided by enclosures for low voltage switchgear and control gear.
- qqqqqqqq) IS-375 – Marking and arrangement of bus bars

dcclxxxvii. Individual equipment housed in the Main & Sub Distribution Board shall Conform to the following IS specifications with upto date amendments if any

- rrrrrrrr) Moulded Case Circuit Breakers IS 2516 (Part I & II/ Sec I) – 1977
- ssssssss) (Fuse Switch & Switch Fuse Units IS 4064 – 1978
- tttttttt) H.R.C. Fuse links IS 2208-1962 or IS 9224-1979
- uuuuuuuu) (Current Transformers IS 2705
- vvvvvvvv) Voltage Transformer IS 3156 (f) Relays IS 32.31

wwwwwwwww)	Indicating Instruments IS 1248
xxxxxxxxx)	Integrating Instruments IS 722
yyyyyyyyy)	Control Switches & Push Buttons IS 6875
zzzzzzzzz)	Auxiliary Contractors IS 2959

dcclxxxviii. Distribution Boards

It includes Supply, Installation, Testing and Commissioning of Distribution Boards standard company fabricated or to be fabricated by fabricator & should be double door type.

Distribution Board shall be double door type with extended loose wire box at the top & suitable for flush installation. All distribution boards shall be of three phase (415 Volts) type with incoming isolator or MCB &/or ELCB as in Chapter of quantities. Distribution boards shall contain plug in or bolted type miniature circuit breaker mounted on bus bars. Miniature circuit breakers shall be quick make & quick break type with trip free mechanism. MCB shall have thermal & magnetic short circuit protection. MCB shall conform to IS 8828-1978. Distribution boards shall comprise of 200A rating copper bus bar, earth terminal, MCB, DP, RCCB and neutral link mounted in three-tier phase wise. All distribution boxed shall be made by approved/licenses MCB/DP manufacturer. The bus bar shall be such that circuit could be isolated easily. Neutral bus bars shall be provided with the same number of terminals, as there are single ways on the board, in addition to the terminals for incoming mains. An earth bar of similar size at the neutral bar shall also be provided. Phase barrier shall be fitted and all live parts shall be screened from the front. Ample clearance shall be provided between all live metal and the earth case & adequate space for all incoming & outgoing cables. All distribution boards enclosures shall have an etched zinc base stove painted followed by synthetic stoved enamel, colour light gray. A circuit identification card in clear plastic cover shall be provided for each distribution board and made from 16-gauge sheet.

Earth leakage circuit breaker/residual current circuit breakers-Earth leakage circuit breaker shall be current operated type and of 100 ma. sensitivity unless otherwise stated. For single-phase distribution, ELCB shall be housed within the DB box. For three-phase distribution board, the ELCB shall be housed in the same box.

dcclxxxix. Metallic Conduct-Wiring System

aaaaaaaaa) Type and Size of Conduit

All conduit pipes shall be of approved gauge (not less than 16 SWG for conduits of sizes upto 32 mm diameter) solid drawn or reamed by welding finished with stove enameled surface). All conduit accessories shall be of threaded type and under no circumstances pin grip type accessories shall be used. The maximum number of PVC insulated 650/1100 volts grade copper conductor cable that can be drawn in conduit of various sizes shall be as per IS: code. No conduit less than 20 mm in diameter shall be used.

bbbbbbbbbb) Conduit Joints

Conduit pipes shall be joined by means of threaded couplers, and threaded accessories only. In long distance straight run of conduits inspection type couplers at reasonable intervals shall be provided or

running threads with couplers and jamnuts shall be provided. In the latter case the bare threaded portion shall be treated with anti-corrosive preservative. Threads on conduit pipes in all cases shall be between 13mm to 19mm long sufficient to accommodate pipes to full threaded portion of couplers or accessories.

ccccccccc) Cut end of conduit pipe shall have no sharp edges or any burrs left to avoid damage to the insulation of conductor while pulling them through such pipes.

dddddddddd) Protection Against Condensation

The layout of conduit should be such that any condensation or sweating inside the conduit is drained out. Suitable precaution should also be taken to prevent entry of insects inside the conduit.

eeeeeeeee) Protection of Conduit Against Rust

The outer surface of conduit including all bends, unions, tees, junction boxes etc. forming part of conduit system shall be adequately protected against rust when such system is exposed to weather by being painted with two coats of oxide paint applied before they are fixed. In all cases, no bare threaded portion of conduit pipe shall be allowed. Unless such bare thread portion of conduit is treated with anti-corrosive preservation or covered with approved plastic compound.

fffffff) Painting of Conduit and Accessories

ggggggggg) After installation, all accessible surface of conduit pipes, fittings, switch and regulator boxes etc. shall be painted with two coats of approved enameled paint or aluminum paint as required to match the finish of surrounding wall, trusses etc.

hhhhhhhhh) Fixing of Conduits

iiiiiiiiii) Recessed/ concealed conduit

jjjjjjjjj) The case in the wall shall be neatly made and of ample dimensions to permit the conduit to be fixed in the manner desired. In the case of building under construction, conduit shall be buried in the wall before plastering and shall be finished neatly after creation of conduit. In case of exposed brick/rubble masonry work, special care shall be taken to fix the conduit and accessories in the position along with the building work. Entire work of chasing the wall, fixing the conduit in chases, and burying the conduit in mortar before the plastering shall form part of point wiring work. The condition pipe shall be fixed by means of staples or by means of saddles not more than 60cm apart or by any other approved means of fixing.

kkkkkkkkk) Fixing of standard bends and elbows shall be avoided as far as practicable and all curves maintained by bending the conduit pipe itself will be treated with some approved preservation compound to secure protection against rust. Suitable inspection boxes to the barest minimum requirement shall be provided to permit periodical inspection and to facilitate replacement of wires, if necessary. These shall be mounted flush with the wall. Suitable ventilating holes shall be provided in the inspection

box covers. Wherever the length of conduit run is more than 10 meters, then circular junction box shall be provided.

IIIIIIII) Outlet Boxes & Covers

The switch box shall be made of metal on all sides except on the front. Boxes shall be hot tip galvanized mild steel. Upto 20 x 30 cm size M.S. box shall have wall thickness of 16 SWG. The metallic boxes shall be painted with anti-corrosive paint before erection. Clear depth of the box shall not be less than 60 mm. All fitting shall be fitted in the flush pattern. Phenolic laminated sheet of approved shade shall be used for switch box covers. These shall be of 3 mm thick synthetic phenolic resin bonded laminated sheet as base material and conform to grade P-1 of IS 2036-1994.

mmmmmmmm) Erection and Earthing of Conduits

The conduit of each circuit or section shall be completed before conductors are drawn in. The entire system of conduit after erection shall be tested for mechanical and electrical continuity throughout and permanently connected to earth conforming to the requirement by means of special approved type of earthing clamp effectively fastened to conduit pipe in a workmen like manner for a perfect continuity between the earth and conduit. Gas, water pipe shall not be used as earth medium.

nnnnnnnn) Switches

All 5 and 15 Amp switches shall be of piano type of 240 volts A.C. grade to be installed. All switches shall be fixed on 3 mm thick laminated sheet cover. All 5 Amp socket shall be 3 pin type. All 15 Amp socket shall be 6 pin type suitable for 15/5 Amp. All switches & sockets outlets controlling the lights or fans shall be connected to the phase wire of the circuit. Switches shall be located at 1200 mm above finished floor level unless otherwise indicated or as directed by the Project Manager/appropriate government authority appointed by GSCDL.

oooooo) Flush Cover Plates

All switches, sockets, telephones and TV outlets etc. shall be fixed on 3 mm thick phenolic-laminated sheet cover unless otherwise specified. Flush cover plate shall be secured to the box with counter sunk brass screws & cup washers.

pppppppp) Wall Socket Plate

All 5 and 15 Amp socket outlet shall be 3 and 6 pin respectively. Each outlet shall have a switch located beside the socket preferable on the same flush cover plate or as per site requirement. The earth terminal of the socket shall be connected to the earth wire.

qqqqqqqq) Wiring

All internal wiring shall be carried out with PVC insulated wires of 650/1100 volts grade. The circuit wiring for points shall be carried out in looping in system and no joint shall be allowed in the length of the conductors. Circuit wiring shall be laid separate conduit originating from distribution board to switch board for light/fan. A light/fan switchboard may

have more than on circuit but shall have to be of same phase. Looping circuit wiring shall be drawn in the same conduit as for point wiring. Each circuit shall have a separate neutral wire. Neutral looping shall be carried out from point to point or in light/ fan switchboards. A separate earth wire shall be used. Red colour wire shall be used for phase and black colour wire for neutral. Circuit wiring shall be carried out with red, yellow or blue colour PVC insulated wire for RYB phase wire respectively and black colour PVC insulated wire for the neutral wires. Bare copper wire shall be used as earth continuity conductor and shall be drawn along with other wires. No wire shall be drawn into any conduit until all work of any nature, that may cause injury to wire is completed. Care shall be taken in pulling the wires so that no damage occurs to the insulation of the wire.

Before the wires are drawn into the conduit, the conduit shall be thoroughly cleaned of moisture, dust and dirt. Drawing & jointing of copper conductor wires & cables shall be as per CPWD Specifications.

rrrrrrrrr) Joints

All joints shall be made at main switches, distribution board socket and switch boxes only. No joints shall be made in conduits & junction boxes. Conductors shall be continuous from outlet to outlet.

sssssssss) Main and Sub mains

Main and sub main cable where called for shall be of the rated capacity and approved make. Every main and sub main shall be drawn into an independent adequate size conduit. Adequate size draw boxes shall be provided at convenient locations to facilitate easy drawings of the sub main & main cables. Cost of junction box/ drawn box is deemed to be included in the rates of sub main wiring. As independent earth wire of proper rating shall be provided for every sub main. Single-phase sub main shall be provided with two earth wire where mains and sub mains cables are connected to the switchgear. Sufficient extra lengths of sub main and mains cable shall be provided to facilitate easy connections and maintenance for termination of cables crimping type cable socket/plugs shall be provided. Some colour code as for circuit wiring shall be followed.

ttttttttt) Load Balancing

Balancing of circuits in three-phase installation shall be planned before the commencement of wiring and shall be strictly adhered to.

uuuuuuuuu) Classification of points

Classification and measurement of point wiring shall be as per Sikkim PWD or CPWD Specifications for Electrical Works – 2013.

vvvvvvvvv) Conductor size

Wiring shall be carried out with following sizes of PVC insulated single core copper conductor wire/ cable.

wwwwwwwww) Light point 1.5 Sq. mm

- Ceiling/Cabin/Exhaust Fan Point 1.5 Sq. mm
- Call Bell Point 1.5 Sq. mm

- Plug Point (5A. outlet) 1.5 Sq. mm
- Circuit Wiring 1.5 Sq. mm
- General Power Point 4.0 Sq. mm
- Power Point for A.C. Unit 6.0 Sq. mm
- Power Point for Geyser, Drinking Water Coolers & 4.0 Sq. mm hand dryers

xxxxxxxxxx) Telephone wire/cables

Separate conduits shall be provided for internal telephone wiring of telephone wiring of telephone system commencing from tag block. Each telephone outlet shall be wired with 2 pair telephone cable from the tag block. All telephone wires shall be of .61 mm diameter annealed tinned high conductivity copper conductor PVC insulated & PVC sheathed gray conforming to ITD specifications SWS 113 B & C. Multipair PVC insulated cables and laid in conduit shall be provided for connecting various tag blocks. Telephone cables used for external connections shall be armoured. This cable shall be laid directly in ground or in pipe etc. as call for elsewhere.

Following number of 2 pair wire/ cables shall be drawn in various sizes of conduits as listed below:

yyyyyyyyyy) 20 mm conduit - upto 3 cables

zzzzzzzzzz) 25 mm conduit - more than 3 and upto 6 cables.

Maximum number of wires that can be taken in any conduit shall be as per the Table given below:

Table 14: Maximum Permissible Number of Wires in a Conduit

Nominal Cross Sectional area of conductor in sq. mm	20 mm		25 mm		32 mm		38 mm		51 mm		64 mm	
	S	B	S	B	S	B	S	B	S	B	S	B
1	2	3	4	5	6	7	8	9	10	11	12	13
1.5	5	4	10	8	18	12	-	-	-	-	-	-
2.5	5	3	8	6	12	10	-	-	-	-	-	-
4	3	2	6	5	10	8	-	-	-	-	-	-
6	2	-	5	4	8	7	-	-	-	-	-	-
10	2	-	4	3	6	5	8	6	-	-	-	-
16	-	-	2	2	3	3	6	5	10	7	12	8
25	-	-	-	-	3	2	5	3	8	6	9	7
35	-	-	-	-	-	-	3	2	6	5	8	6
50	-	-	-	-	-	-	-	-	5	3	6	5
70	-	-	-	-	-	-	-	-	4	3	5	4

Note:

dccxc. The above table shows the maximum capacity of conduits for a simultaneous drawing in of cables.

dccxc. The columns headed IISII apply to runs of conduits which have distance not exceeding 4.25 m between draw in boxes and which do not defect from the straight by an angle of

more than 15 degrees. The columns headed —BII apply to runs of conduit, which defect from the straight by an angle of more than 15 degree.

dccxcii. Conduit sizes are the nominal external diameter.

Lighting Fixture and Fans, Air Cooling & AC

General

- dccxciii. The Contractor shall apply and install lighting fixtures including but not limited to lamps, ballasts, accessories fixing hardware necessary for installations, as required, and as herein specified.
- dccxciv. All fixtures shall be delivered to the building complete with suspension accessories, canopies, casing, sockets, holders, reflectors, ballasts, diffusing material, louvers, plaster frames, recessing boxes, etc. all wired and assembled as indicated.
- dccxcv. Fixtures, housing, frame or canopy, shall provide a suitable cover for fixture outlet box or fixture opening.
- dccxcvi. Fixtures shall comply with all applicable requirements as herein outlined unless otherwise specified.
- dccxcvii. Manufacturer's name and catalogue number of lighting fixtures are given for general reference only. It shall be understood that the actual fixtures supplied shall meet all the requirements of the specification, and if necessary, the standard fixture indicated for reference, shall be modified accordingly.
- dccxcviii. Fixtures shall bear manufacturer's name and the factory inspection label.
- dccxcix. Fixtures shall be completely wired can constructed to comply with the IEE wiring regulations requirements for lighting fixtures, unless otherwise specified.
 - dccc. Re-clamping the fixture shall be possible without having to remove the fixture from its place.
 - dccci. Lamps of the proper type, wattage and voltage rating shall be furnished and installed in each fixture.

Construction

- dcccii. Fixture shall be constructed of 0.5mm thick steel minimum. If other metals are used they shall be of the required thickness to have at least the same mechanical strength. Cast portions of fixtures shall be not less than 1.5 mm thick.
- dccciii. Metal parts of the fixture, shall be completely free from burrs & tool marks.
- dccciv. Solder shall not be used as a mechanical fastening device on any part of the fixture joints shall be welded and ground smooth.
- dcccv. Fixtures with visible frames shall have concealed hinges and catches.
- dcccvi. Recessed fixtures shall be constructed so as to fit into ceiling without distorting either the fixture or the ceiling. Plaster rings shall be provided for plaster ceilings. The Contractor shall coordinate the dimensions with the false ceiling tile dimensions.
- dcccvii. Outdoor fixtures (under canopy or directly exposed to the weather) shall be constructed of an appropriate weather resistant material including gasketing-

- preventing entrance of water into wiring, and shall be marked by the manufacturer – Suitable for outdoor use.ii
- dcccviii. Fixture with hinged diffuser doors shall be provided with spring clips or other retaining devices to prevent the diffuser from moving.
- dcccix. All plastic diffusers shall be of acrylic, unless otherwise noted.
- dcccx. Incandescent fixtures shall be equipped with porcelain medium base with nickel- plated shells.
- dcccxi. Pendent fixtures and lamp holders shall be provided with ball type aligners.
- dcccxii. Fluorescent fixtures shall be provided with white lamp holders.
- dcccxiii. Industrial type fluorescent fixtures shall have turret type lamp holders

Finish

- dcccxiv. All hardware shall be bonderised, cadmium plated, given a corrosion resistant phosphate treatment or other approved rust inhibiting prime coat, to provide a rust proof base before application of finish. Finish shall be baked enamel.
- dcccxv. Non-reflecting surfaces such as fixture frames and trims shall be finished with baked enamel paint, unless otherwise specified. The colour of the paint shall be as directed later by the Project Manager/appropriate government authority appointed by GSCDL.
- dcccxvi. Light reflecting surfaces shall be finished with baked white enamel paint having a reflection factor of not less than 85%.
- dcccxvii. All parts of the reflector shall be completely covered by the finished and free from irregularities.
- dcccxviii. Unpainted surfaces shall finished with a clear lacquer except for anodized or –Azacsurfaces.
- dcccxix. After finish has been applied and cured, it shall be capable of withstanding a 1 cm radius bend without showing signs of cracking, peeling or loosening from the base metal.
- dcccxx. Finish shall be capable of withstanding 72 hours exposure to an ultra – violet.
- dcccxxi. RS sun lamp placed 10 cm from the surface without discoloration, hardening, or warping and shall retain the same reflection characteristics after exposure.

Wiring

- dcccxxii. Fluorescent fixtures shall be wired with not lesser than 1.5 sq mm asbestos- covered wire. No splice or tap shall be located within an arm, stem or chain. Wire shall be continuous from splice in outlet box of the building wiring system to lamp socket or to ballast terminals.
- dcccxxiii. Wiring within incandescent fixtures and for connection to the branch circuit wiring up to the outlet box of lighting point shall not be less than 1.5 sq mm silicone rubber insulated wire. (150 degree centigrade temperature)

Installation

- dcccxiv. Fixtures shall be installed at mounting heights as instructed on site by the Project manager/ appropriate government authority appointed by GSCDL. Pendent fixtures within the same room or area shall be installed plump and at a uniform height from the finished floor. Adjustment of height shall be made during installation. Flush mounted recessed

fixtures, shall be installed so as to completely eliminate leakage of light within the fixture and between the fixture and adjacent finish.

- dcccxxv. Fixture mounted outlet boxes shall be rigidly secured to a fixture stud in the outlet box. Hickeys or extension pieces shall be installed where required to facilitate proper installation. Fixture located on the exterior of the building shall be installed with non-ferrous metal screws finished to match the fixtures.

Lamps-General

- dcccxxvi. Lamp shall be supplied and installed in all lighting fixtures listed in the Schedules of lighting fixtures on the drawings.
- dcccxxvii. Lamps used for temporary lighting service shall not be used in the final lamping of fixture units.
- dcccxxviii. Lamps shall be of wattage and type as shown in this Schedule.
- dcccxxix. Lamps for permanent installation shall not be placed in the fixtures, until so directed by the Project Manager/appropriate government authority appointed by GSCDL and this shall be accomplished directly before the building areas are ready for occupancy.
- dcccxxx. LED lights & fittings shall be used.

Fixture Samples

Detailed catalogue for all fixtures or as required by the Project Manager/appropriate government authority appointed by GSCDL, sample fixtures shall be submitted for prior approval of the Project Manager/appropriate government authority appointed by GSCDL before orders for the fixtures are placed.

Testing

After all lighting fixtures are installed and are connected their respective switches, test all fixtures to ensure operation on their correct switch in the presence of the Project manager/ appropriate government authority appointed by GSCDL. All un-operating fixtures or ones connected to the wrong or inconvenient located switch shall be correctly connected as directed by the Project Manager/appropriate government authority appointed by GSCDL.

Ceiling Fans

All ceiling fans shall be provided with suspension arrangement in the concrete/slab/roof member. Fan box with MS hook to be provided under by electrical Contractor covered under subhead point wiring item no. 1 ceiling fan shall be double ball bearing type, copper wound motor complete with canopy, down rod, blades etc. and shall conform to relevant IS standards. Ceiling fan shall be white in colour. Ceiling fan shall be provided with standard regulator. Regulator shall be suitable for 240 volts A.C. supply 50 Hz and shall be of continuous duty type.

Exhaust Fans

Exhaust fans shall be heavy-duty type with double ball bearing & conforming to IS 2312-1967. Exhaust fan shall be complete with copper wound motor, capacitor, louvers/shutter frame & mounting bracket. Exhaust fan shall be suitable for operation on 240 volts single phase A.C. supply.

Wiring

- dcccxxxi. All the wiring outside the panel interconnection between AMF and DG set shall be drawn into 14 gauge MS conduits or enclosed trunking.
- dcccxxxii. The minimum size of wire outside the AMF panel shall be as per the requirement of electric load and adequate size.
- dcccxxxiii. The size of control cable inside the panel shall be 2.5 sq. mm copper control cable.
- dcccxxxiv. All the wires and cables shall be suitable for 650/1100 volts.
- dcccxxxv. All the wiring shall be carried out as per IS: 700 / IS 732

Earthing

General

All the non-current metal parts of electrical installation shall be earthed properly. All metal conduits trunking, switchgear, distribution boards, switch boxes, outlet boxes and all other parts made of metal shall be bounded together and connected by means of specified earthing conductors to an efficient earthing system.

Earthing work shall be conforming to Sikkim PWD or CPWD Specifications for Earthing work and IS 3043.

Earthing Conductor

Earth continuity conductor along with sub main wiring from Main/ Sub Distribution boards to various distribution boards shall be of copper. Earth continuity conductor connecting Main & Sub Distribution boards to earth electrode shall be with galvanized MS strip.

Plate Earth Electrode

Earthing shall be provided with either GI Plate electrode or copper plate electrode of following minimum dimensions:

GI Plate Electrode 600m x 600mm x 6mm thick

Copper Plate Electrode 600m x 600mm x 3 mm thick

The electrode shall be made cylindrical buried in ground with its faces vertical and not less than 3 meters below ground level 20 mm diameter medium class GI Pipe shall be provided and attached to the electrode. A funnel with mesh shall be provided on the top of this pipe for watering and earth electrode. Earth electrode the watering funnel attachment shall be housed in masonry enclosure of not less than 300x300x300 mm deep. A cast iron or MS frames with cover having locking arrangement shall be provided at top 3 meters from the building. Care shall be taken that the excavation for earth electrode may not affect the column footing or foundation of the building. In such cases electrode may be further away from the building.

If the earth resistance is too high and multiple electrode earthing does not give adequate low resistance to earth, then the soil resistivity immediately surrounding the electrode shall be reduced by addition of sodium chloride calcium chloride, sodium carbonates copper sulphate, salt and soft coke or charcoal in suitable proportions.

Resistance to Earth

The resistance of earthing system shall not exceed 2 ohm.

Commissioning Check List of Electrical Works

Scope

Before commissioning of the electrical installations the Contractor shall check all the items mentioned and arrange for testing of all the equipments in the presence of the Project Manager/appropriate government authority appointed by GSCDL.

dcccxxvi. Functional Checking

- aaaaaaaaaa) Check all closing, tripping, supervision & interlock of control devices. (b) Check operation of all alarm circuits.
- bbbbbbbbbb) All 415 and 230 V power cables to be meggered.

dcccxxvii. Earthing

- ccccccccc) Measure resistance of each earth well/rod by isolating the same from station grid as well as from other earth well/ rods and when resistance of two earths at a time measure by D.C. drops method.
- dddddddddd) Check continuity of grid conductors and wires.
- eeeeeeeeee) Soil resistivity tests.
- ffffffffff) In addition to the above any other specified by manufactures shall be carried out as per manufacturer's instructions.
- gggggggggg) Measurement voltage across bearing pedestal insulation & between rotor shaft & bearing.
- hhhhhhhhh) Test the fire detection system if provided.
- iiiiiiiiii) Check operation of protection relays by putting short circuit bat at different location.
- jjjjjjjjjj) Check open circuit and short circuit characteristics of generators. Check load characteristics of exciters.

dcccxxviii. Metals

- Check nameplate details according to specification.
- Physical check for any damage.
- Check calibration by comparing it with a substandard meter.
- Megger all insulated portions.
- Check C.T. and V.T. connections with particular reference to their polarities for power type meter.

dcccxxix. Relays

- Check nameplate details according to specifications.
- Check for any physical damage.
- Check internal wiring.
- Megger all terminals to body; Megger AC to DC Terminals.

Check operating characteristics by secondary injections
Check minimum pick up voltage of D.C. coils.
Check operation of electrical / mechanical targets.
Relay settings.
Check C.T. and V.T. connection with particular reference to their polarities for directional, distance type relays.

dcccxl. Current Transformer - Preliminary checks

Check nameplate details according to specification.
Check for physical damage
Check tightness of all bolts, clamps, connecting terminals
Check for oil level and leakages
Check connections
Check cleanliness of insulators and bushings

dcccxli. Commissioning Checks

Megger between winding & winding terminals to body
Polarity test:
Ratio identification checking of all ratios on all cores by primary injection of current.
Magnetization characteristics, secondary winding resistance
Capacitance and tan – deltas test
Dielectric test of oil (wherever applicable)
Spare CT cores, if any to be shorted and earthed.

dcccxlii. Control Panels - Preliminary Checks

Check name plate details of every associated equipment according to Specifications
Check for physical damage
Check tightness of all nuts, clamps, connecting terminals.
Check cleanliness
Check earthing

dcccxliii. Commissioning Checks

Switch developments
Each wire shall traced by continuity tests & it should be made sure that the wiring is as per relevant drawings. All interconnections between panel/ equipment shall be similarly checked.
All the wires should be meggered to earth
Checks on relays
Checks on motors
Settings of relays, other alarm, tripping devices interlocks as per schemes

Phase angle checks measurements of magnitude and phase angle of current transformer secondary currents and potentials transformer secondary voltages.

Functional checking of all control circuit e.g. closing tripping. Control, interlock, supervision and alarm circuit including proper functioning of the component equipments.

dcccxliv. Diesel Generating Set

Factory Tests

Factor test shall incorporate the following:

Routine tests

High voltage tests

Short circuit tests

Instantaneous short circuit. Withstanding test

Insulation resistance test.

The Contractor shall furnish type tests certificate for Project Manager/appropriate government authority appointed by GSCDL. These tests shall be conducted as per the requirement of BIS: 2613 or IS : 4722 and the original test certificate shall be furnished.

dcccxlv. Site Tests

After erection is completed following test shall be conducted.

Insulation resistance of the generator.

Speed no load voltage and full load voltage regulation

Frequency on no load half load and full load

Full load test for 6 hrs at rated voltage, speed & frequency

The readings shall be observed with calibrated meter. Only meter shall be used for the test. The reading shall be properly tabulated submitted in triplicate to the Project Manager/appropriate government authority appointed by GSCDL.

dcccxlv. Testing Of Control

All the safety control and protection devices of the DG set shall be tested for correct calibration and operation. The result of the test shall be tabulated and submitted in triplicate to the Project Manager/appropriate government authority appointed by GSCDL.

dcccxlvii. Trials - Preliminary Trials

After completion of erection of DG set and before carrying out main trials. Preliminary trials shall be conducted in the presence of the Project Manager/appropriate government authority appointed by GSCDL; such trials include the checking and adjustment of all instruments relays timers' interlocks and meters. Crankshaft alignment shall be checked when the engine is cold insulation of stator, rotor & exciter windings reading recorded.

dcccxlviii. Main Trials

Main trial shall be of 12 hrs continuous run at full load and including one hour at 110% of full load.

dcccxlx. AMF Panel and Engine Trial

AMF Panel and engine control panel shall be tested for automatic operation by injecting proper current one voltage by a separate source. The satisfactory working of automatic operation shall be tested & necessary adjustment shall be done for relays in the presence of the Project Manager/appropriate government authority appointed by GSCDL and the result shall be recorded in the test sheet at 30 minutes interval. Alternator efficiency as determined in works test shall be used as the basis of calculation for fuel consumption rate. Test providing the satisfactory performance of all safety and operating controls shall be carried out. Starting time of sets shall be tested at least five times and the sufficient time interval to allow for cold start. A set of tools and tackles has to be supplied along with each set and shall be included in the cost of DG set.

dccl. Transformer - Preliminary Checks

- Compare name plate details with the specifications
- Check for any physical damage, in particular of bushings
- Check tightness of all bolts, clamps, connecting terminals
- Check cleanliness of bushings
- Check for oil leakage and oil level
- Breather condition, check whether breathing line is free, silica jet is reactivated oil in available at the bottom.
- Check for clearances, particularly in case of bus ducts
- Water tightness of terminal boxes and bus ducts.
- Ensure that all cooler and cooler header valves are opened
- Releasing of air from bushings (Very important) Buchholz relay.
- Check the bushing horn gaps
- Check that the transformer is correctly installed with reference to its phasing

dccli. Commissioning Tests

- Test the transformer oil for dielectric strength, tan-delta, and activity resistivity and dissolved gases.
- Test bushing oil for dielectric strength.
- Insulation test of winding (including tertiary winding if available).
- Capacitance and tan-delta test of condenser type bushings, before assembly.

dccli. Test the Transformer for the following

- Voltage/turns ratio at all the taps
- Winding resistance at all the taps
- Short circuit impedance at full winding
- Magnetic balance at full winding
- Core loss at service tap at low voltage
- Capacitance and tan-delta

IR and PI
Vector group test
Phase sequence test

dcccliii. Current Transformer

Continuity test
Polarity test
Insulation resistance tests
Magnetization characteristics
Rough ratio test
Secondary winding resistance
Line connection as per phasing diagram
Winding resistance
Insulation resistance of control wiring
Core load test
Buchholz relay operation for alarm and trip
OLTC control indicating and alarm circuits
Operation test of all protective devices and interlocks
Calibration of temperature indicator (oil & winding temperature relays)

dcccliv. Cooling System

Fan motor rating and fan mounting (wherever applicable)
Oil pumping equipment (wherever applicable)
Operation of valves
Operation of flow switches
Operation test of cooling equipment
Check fan motors for insulation, continuity, vibration and temperature rise and direction of rotation.
Check the lightning arrester installation

Safety Equipment

dccclv. Danger Notices

Danger notices shall be affixed permanently in a conspicuous position in Hindi or English and the local language of the district with sign of skull and bones at every overhead lines, transformer, electrical equipment motors, etc.

dccclvi. First aid box

Standard first aid box with all standard contents shall be supplied.

dccclvii. Fire buckets

The fire buckets unit shall consist of four galvanized iron baskets which shall be with round bottom and of 13 litres capacity. They shall be filled with dry sand. Arrangement shall be made to hang

them on GI Pipe stand comprising of at least 2 vertical and one horizontal members of 500 mm GI Pipe. The stands have books and locking chain arrangement. The buckets and stand shall be painted with epoxy red paint.

dcclviii. Fire extinguisher

Fire extinguisher of 4.5 kg. capacity shall be of approved make. It shall be filled with Carbon tetrachloride. It shall have horns. Extinguishers shall be fixed on wall/ columns with necessary clamps made out 50 mm x 6 mm MS flat and coated bolts and nuts ground in wall/ columns.

dcclxix. Instruction Chart

Printed instruction chart shall be in English, Hindi and local dialects, duly framed with front glass, prescribing treatment to be persons having Electric shock, shall be supplied.

Drawing, Procurement & Inspection of Equipment

Based on the proposal drawings and the equipment/ scheme finally selected, the Contractor shall supply layouts, cable line diagrams etc. required for the satisfactory and complete installation of the total electrical power supply and distribution system. Some of the important drawings/ details to be submitted for approval are given below.

- dcclxi. General arrangement drawings of DG equipment, LT switchgear, Panels, transformers ducts, etc.
- dcclxii. Single line and three line diagrams of DG set and sub-station.
- dcclxiii. Wiring diagram, schematic diagrams and control diagrams for equipments, Switchgear, PCC and the whole system. Chapter and termination details shall also be provided.
- dcclxiv. Building plan, elevation / section and details including the layout of plant, equipment, switchgear, bus ducts and related services like chimneys, cooling systems, fuel handling system etc. with dimensions based on the equipment finally selected.
- dcclxv. Details of all foundations, cable ducts, cable protections pipes and other civic works.
- dcclxvi. Complete Chapter for LT Cables, instrument/ control cables.
- dcclxvii. Layout plan showing the coordinates/ routing for power cables. Control / instrument cables and other cables as required, coordinated with other services, like water supply line, drainage/ sewerage lines, fire lines, mechanical service pipes line etc. The sectional details, road-crossing details etc. shall also be given at different locations.
- dcclxviii. Technical catalogue for all equipment, switchgear, cables and materials including a complete wire up / details of operation, interlocks and control etc.
- dcclxix. Operation and maintenance manuals along with list of spare parts for all equipments, switchgear, cables and materials etc.
- dcclxx. A detailed explanatory note giving the details of operational sequence, time period and safety aspects etc. on changeover from P.S.E.B supply source to stand by D.G. power.
- dcclxxi. Procurement & Inspection of Equipment

Approval list of makers and vendors are given. The Project manager/ appropriate government authority appointed by GSCDL reserves the right to amend make of equipments/materials. Materials supplied shall be strictly as mentioned therein. For items not specifically mentioned, prior approval shall be taken before procurement of the same, all equipment/ material/ supplied

shall be brand new and shall be procured directly from the manufacturers, dealers or authorized agents. The Project manager/ appropriate government authority appointed by GSCDL shall have access to the manufacturer's premises for stage inspection / final inspection of any item during its design, manufacturing, assembly, and testing. After carrying out the necessary factory tests and routine tests as per IS standards, a copy of the routine test certificates shall be forwarded along with the call for carrying out the inspection at the manufacturers' works.

PA system

Scope: Scope includes supply, Installation, testing & commissioning of PA System complete in all respect as per drawing or directed by Project manager/ appropriate government authority appointed by GSCDL. The System should be clearly audible

List of Approved Makes

- dccclxxi. Moulded Case Circuit Breakers / A.C.B's : GEC Alstom (English Electric), L & T Siemens. Switch Fuse Unit : L & T, GEC Alstom (English Electric) Siemens or equivalent
- dccclxxii. Voltmeter & Ammeter : AE, MECO, Rishline (L & T), Rishab or equivalent
- dccclxxiii. Selector Switch : Kaycee, L & T, BCH or equivalent
- dccclxxiv. Current Transformer : Kappa, Rishline (L & T), Jyoti or equivalent
- dccclxxv. Indication Lamp : L & T, BCH, Siemens or equivalent
- dccclxxvi. Panels, MBS, SDB's, Main : As per specifications & Sub Distribution Boards approval of the manufacture to be obtained from the Project manager/ appropriate government authority appointed by GSCDL. and manufacturer shall have CPRI, test certificate for panel or from a source with prior approval of the Project manager/ appropriate government authority appointed by GSCDL.
- dccclxxvii. Distribution Board with Miniature Circuit Breakers: Morarji Dorman Smith (MDS), Siemens, GEC Alstom (English Electric), Standard, L & T, Plaza or equivalent.
- dccclxxviii. XLPE Insulated PVC sheath Armoured cables of 1.1 KV grade as per IS : 1554 : ICL, Fort gloster, CCI(Cable Corporation of India), NICCO, Paramount or equivalent.
- dccclxxix. FRLS Insulated copper conductor single core standard wires of 650/ 1100 volt grade: National, Finolex, RPG, and FordGloster, Paramount or equivalent.
- dccclxxx. Switches & Sockets : Anchor, SSK, Havells, MK or equivalent.
- dccclxxxi. Telephone Wire : National, Plaza, Universal, NICCO, Paramount, Finolex or equivalent
- dccclxxxii. M.S. Conduit (BIS marked) : BEC, NIC, Steelcraft, AKG or equivalent
- dccclxxxiii. Fluorescent Light Fixture: Philips, Wipro, Bajaj Incandescent Light fixture. Bajaj, Decon, Philips or equivalent.
- dccclxxxiv. Ceiling fan & Cabin fan : Crompton, Bajaj, Usha or equivalent
- dccclxxxv. Earth Leakage Circuit Breajers/RCCB: MDS, GEC Alstom (English Electric) Datar, L & T/ Hager, Siemens, Plaza or equivalent.
- dccclxxxvi. Diesel Generator Set; Kirloskar, Ashok Leyland, Greaves cotton, Ruston, Stampford or equivalent.
- dccclxxxvii. Alternator : Kirloskar, Greaves, Stampford, Jyoti or equivalent
- dccclxxxviii. 11 KV Switch gear with VCB/Load break switch: SIEMENS, L & T, B.H.E.L., GEC Alstom or equivalent.
- dccclxxxix. 11 KV/0.433 KV Transformer: GEC Alstom B.H.E.L., Bharat Bijle, Kirloskar, Voltas or equivalent.

- dcccxc. 11 KV cable: Cable Corporation of Indiameter, Fort Gloster, Industrial Cable Universal Cable, Torrent, Paramount or equivalent.
- dcccxi. Capacitors: L & T, GEC, C & G, Asian or equivalent
- dcccxcii. H.T. Termination: Xencon (CCI) Raychem, Dension Mahindra & Mahindra or equivalent.
- dcccxciii. Street light fixture: Philips, Bajaj, Wipro, Crompton or equivalent.
- dcccxciv. Amplifier: Boss, Ahuja. Bosch or equivalent.
- dcccxcv. Speaker: Boss, Ahuja, Bosch or equivalent.
- dcccxcvi. LT Panels : Advance, Adlec, Tri Square, Diamond Electric, Sudir Gensets or equivalent
- dcccxcvii. 11 KV HT Panels: Advance, Adlec, Tri Square or equivalent

Note: The above list is indicative but not exhaustive.

Below are Some IS Codes to be referred

Internal External work

Indian Standard	Reaffirmation	Subject
27-1992	Reaffirmed2002	Specifications for Pig Lead
269-1989	Reaffirmed2004	Specificationsfor33 grade Ordinary Portland Cement
407-1981	Reaffirmed2001	Brass tubes for general purposes
456-2000	--	Code of practice for Plain & Reinforced concrete
458-2003	--	Specifications for Concrete pipes
554-1999	--	Dimensions for pipe thread where pressure tight joints are required
636-1988	Reaffirmed2003	Firefighting hose, rubber lined or fabric reinforced rubberlined woven Jacketed
638-1979	Reaffirmed2003	Sheet rubber jointing & rubber insertion jointing
651-1992	Reaffirmed2003	Specifications for Salt Glazed stone ware pipes & fittings
771(P-I&VI)		Glazed fire clay sanitary appliance
771-1979(P-I)	Reaffirmed2003	General requirements
771-1985(P-II)	Reaffirmed2003	Specific requirements for kitchen &laboratory sinks
771-1979(P-III)	Reaffirmed2003	Specific requirements of urinals
771-1985(P-III)	Reaffirmed2000	Specific requirements of urinals
771-1979(P-IV)	Reaffirmed2003	Specific requirements of post mortem slabs
771-1979(P-V)	Reaffirmed2003	Specific requirements o f shower trays
771-1979(P-VI)	Reaffirmed2003	Specific requirements of bed pan sinks
771-1979(P-VII)	Reaffirmed2003	Specific requirements of slopes inks
774-1984	Reaffirmed2000	Flushing cistern for watercloset & urinals

For Electrical Installation Codes as below or as directed by Project Manager/appropriate government authority appointed by GSCDL

CODES: Codes shall mean the following including the latest ascendants and / or replacement if any.

1. Indian Boiler Act, 1923 and Rules and Regulations made there under
2. Indian Electricity Act, 1923 and Rules and Regulations made there under
3. Indian Factories Act, 1948 and Rules and Regulations made there under
4. The minimum wages Act
5. The Women's Compensation Act
6. The Payment of Wages Act
7. The Fatal Accident Act
8. The Industrial Employment Act
9. The Employment provident Fund Act
10. Indian Explosive Act 1984 the Rules and Regulations made there under
11. Indian Petroleum Act 1934, and Rules and Regulations made there under
12. A.S.M.E. Test Codes
13. AIRE Test, Codes
14. American Society of Materials Testing Codes
15. Standards of the Indian Standards Institution
16. Electricity Act 2003
17. Electricity Rule 2005
18. Low Tension Circuit Breakers: IS 2516-1955 Part I Sec.1
19. Switchgear Bus Bars IS 375-1963
20. HRC fuse links IS 2208-1962
21. Distribution fuse boards IS2675-1966
22. Enclosure for Low Voltage switchgear IS214701962
23. PVC Cables IS1554-1975
24. Tubular fluorescent lamps for Cameral lighting service IS2418-1963
25. Tungsten Filament Lamps for cameral service IS415-1963
26. Ceiling Fans IS274-1966 10) Flood lights IS1947-1961
27. Wall Glass flame-proof electric light fittings IS2206-1962 (Part 1)
28. Water Tight Electric Light Fittings IS3553-1956
29. Steel Boxes for Enclosure of Electrical Accessories IS5133-1969
30. Fittings for Rigid Steel conduit IS2667-1979
31. Rigid steel circuits for electrical wiring IS3837-1966
32. Accessories for Rigid Steel Conduits for Electrical Wiring IS3837-1966
33. Switch Socket Outlets IS3837-1966
34. PVC Wiring IS694-1977
35. Switches for domestic and similar purpose IS3854-1966
36. PVC wiring IS694-1977
37. Call Bell and Buzzers IS2268-1966
38. Straight through joint boxes and leads sleeves or paper insulated cables- EID-0032-1964 147
39. Earthing IS3043-1966
40. Electrical Wiring installations IS732-1963
41. Switchgear IS3072-1965 (Part I)
42. Lighting protection IS2309 –1969
43. Public Address system IS1882-1962
44. Low Tension switch use units IS4064-1978

45. Code of Practice for Automatic FIRE ALAM system IS2189-1970
46. Specification for Heat Sensitive Fire Detectors IS2175-1977
47. Guide for Safety procedure in Electric work IS5216-1969
48. Rubber Mats for Electric works IS5424-1969
49. Other internationally approved standards and / or Rules and Regulations touching the subject matter of the contract

ACOUSTICAL DESIGN OF AUDITORIUMS AND CONFERENCE HALLS

Indian Standards

dcccxcviii. The following Indian standards applied to acoustical design:

I.S. Code	SUBJECT
2526-2006	Specification for acoustical design of auditoriums and conference halls

dcccxcix. A summary of common acoustical defects usually noticed in auditoriums and conference halls as also recommendations for remedying the same are given in *Appendix A* for guidance.

Scope

cm. This standard covers acoustical requirements and design of various types of auditoriums and conference halls.

kkkkkkkkkk) This code does not give, recommendations for ancillary facilities, such as lighting, air-conditioning, firefighting, toilets, number and size of emergency exits, etc., to be provided in auditoriums and conference halls. These shall be provided in accordance with relevant Indian Standards, wherever available, and local regulations, if any.

Acoustical Requirements

cmi. Halls Used for Speech and/or Drama -The clarity of speech is most important in this case.

Optimum clarity depends on:

correct reverberation time,
absence of echo,
correct loudness level at all parts of the hall, and
low background noise.

cmii. Halls for Music proper - Adequate reverberation is important to lend blending and fullness of music. The reverberation time is required to be higher than for halls meant for speech only.

cmiii. General Purpose Halls Used for Both Speech and Music –The reverberation time should be in-between that provided for in (i) and (ii) given above.

cmiv. Cinemas (Sound Picture Halls) - In view of the fact that a certain amount of reverberation is already present in the recorded sound, the reverberation time required in this case is lower than that required for (iii) given above.

- cmv. Open-Air Auditoriums and Conference Halls-While the general acoustical requirements are similar to those specified for halls [see (i) given above], additional requirements which arise are dealt with in 10

General Principles of Design

- cmvi. Site Selection and Planning - The choice of site for an auditorium is governed by several factors which may be mutually conflicting, but a compromise has to be struck between the various considerations involved. The problem of noise is an important consideration. A noise survey of the site should be made in advance so that noisy locations are avoided where, possible, as otherwise elaborate and expensive construction may be required to provide requisite sound insulation. In fact, the quietest possible condition should be provided so that intelligibility of speech does not suffer and even soft passages of music are heard. It is particularly necessary to keep the level of extraneous noise low by proper orientation and site selection in cases where no air-conditioning is provided and doors and windows are normally kept open during the performance. When air-conditioning is provided, special care should be taken to attenuate the plant noise 2nd the grill noise. For this purpose plant should be suitably isolated and ducts as well as the plenum should be so designed that noise gets adequately reduced so as to be within the permissible limits.

Depending on the ambient noise level of the site, orientation, layout and structural design should be arranged to provide necessary noise reduction, so that the background noise level of not more than 40 to 45 dB (as measured on 'A' scale of sound level meter) is achieved within the hall.

NOTE Decibel (dB) is a unit of sound intensity level and expresses the ratio of a given sound level to the minimum perceptible level (quantitatively 0.0002 dynes/cm²) on a logarithmic scale.

Size and Shape

- cmvii. The size should be fixed in relation to the number of audience required to be seated. The floor area of the hall including, gangways (excluding the stage) should be calculated on the basis of 0.6 to 0.9 m² per person. The height of the hall is determined by such considerations as ventilation, presence (or absence) of balcony and the type of performance.

The average height may vary from 6 m for small halls to 7.5 m for large halls. Ceiling may be flat but it is preferable to provide a slight increase in the height near the centre of hall. The volume per person required to be provided should normally range between 3.5 to 5.5 m³. Suitable volumes for different types of auditoriums are given below but it is recommended that higher values be adopted only in special cases:

Cubic Metres per Person

- Public lecture halls 3.5 to 4.5

- Cinemas or theatres 4.0 to 5.0
- Musical halls or concert halls 4.0 to 5.5

|||||||) Floor plans of various shapes are used, but the one which is considered to give satisfactory results without introducing complications in the acoustical treatment of the hall is the fan-shaped plan. The proscenium may bear any suitable ratio with the height of the hall to suit stage requirements and considerations of visibility. The side walls should be arranged to have an angle of not more than 100 degrees with the curtain line. In the case of talking pictures synchronization of sound with lip movement is most essential. Also, in the case of theatres a person with normal vision should be able to discern facial expressions of the performers. In order to satisfy these conditions, it is recommended that the distance of the 'farthest seat from the curtain line should not normally exceed 23 metres.

Stage - The size of the stage depends upon the type of performance the hall is to cater for. It would be large for theatres, while it would be comparatively small for cinema halls which again depends on the size of the screen.

Rear Wall -The auditorium rear wall(s) should be either flat or convex in shape. This should not be concave in shape, but where it cannot be avoided, the acoustical design shall indicate either the surface to be splayed or convex corrugations given in order to avoid any tendency for the sound to focus into the hall.

Side Wall -Where the side walls are non-parallel as in the case of a fan-shaped hall, the walls may remain reflective and may be architecturally finished in any manner required, if sound absorbing material is not required from other considerations. Where the side walls are parallel they may be left untreated to a length of about 7.5 m from the proscenium end. In addition, any of the surfaces, likely to cause a delayed echo or flutter echo should be appropriately treated with a sound absorbing material. Difference between the direct path and the path reflected from side walls shall not exceed 15 m.

Roof and Ceiling -The requirements pertaining to a roof are mainly governed by architectural, engineering or economic considerations. In large halls a false ceiling is usually provided below the trusses. The portion of the false ceiling near the proscenium is constructed of reflective material (usually plaster of Paris) and is suitably inclined to help reflections from the stage to reach the rear seats of the hall. The remaining portion of this ceiling is constructed to take acoustical treatment. Concave shaped ceilings (in the form of dome or barrel) should be avoided. The rear portion of the ceiling may be treated with sound absorbing material partly for control of reverberation and partly to prevent build-up of audience noise.

Noise from aircrafts - If the auditorium is so located that aircraft noise causes a serious disturbance (that is when noise level created inside the

hall is more than 50 dB) special precautions should be taken to make the ceiling soundproof. A suitable soundproof false ceiling should be provided below the roof under such circumstances.

mmmmmmmmmm) Rain noise - Wherever this problem arises due to frequent and heavy showers the same method should be followed as suggested for noise from aircrafts [see (g) given above]

nnnnnnnnnn) Floor - For good visibility as also for good listening conditions, the successive rows of seats have to be raised over the preceding ones with the result that the floor level rises towards the rear. The elevation is based on the principle that each listener shall be elevated with respect to the person immediately in front of him so that the listener's head is about 12 cm above the path of sound which would pass over the head of the person in front of him. It is possible to reduce this to 8 cm, if the seats are staggered. As an empirical rule the angle of elevation of the inclined floor in an auditorium should not be less than 8 degrees.

NOTE - Where more accurate values are considered necessary, the slope of the floor may be calculated by the following formula:

$$h_n = h_{n-1} + h - (r(H - h_{n-1}) / S + (n-1)r)$$

where

H = height of sound source above normal head level;

r = back to back distance between rows of seats;

h = 'head clearance' in relation to the sound source, the difference in height between one row of people and the next;

s = $(rH/h + r)$ = horizontal distance from the source to the last row which does not require elevation; and

h_1, h_2 and h_n are elevations of the first, second and n^{th} rows behind the row which is at a distance S from the source.

oooooooooooo) Balcony - Where a balcony is provided, its projection into the hall should not be more than twice the free height of the opening of the balcony recess.

pppppppppppp) Line of Sight - The elevation of the balcony seats should be such that line of sight is not inclined more than 30 degrees to the horizontal.

qqqqqqqqqq) Foyers, Crush Halls, Attached Rooms - All the enclosed spaces, such as foyers, lounges, flanking verandahs, etc., adjacent to the auditorium should be isolated from the main hall by suitable (well fitting) doors so that the acoustics of the hall are not influenced by these rooms; heavy curtains may be used to aid absorption of external noise from foyers, verandahs, etc.

- The foyer area, number and size of entrances also depend on the size and seating capacity of the auditorium. At least 20 percent of the seating area of the hall is recommended for foyer.
- For lobby and lounge, areas at least corresponding to 10 percent of the seating area in the hall are recommended.
- Further, these spaces should be acoustically treated so that the noises originating there do not cause any disturbance in the main hall. Incidentally, this will also reduce air-borne noises coming from outside.
- Doors and Windows -Where the external noise level is high, properly fitted doors and windows should be provided. Their rebates should preferably be lined with draught strip rubber or felt.
- In the case of existing doors and windows where leakage of sound is observed, it would be necessary to improve the fitting of the shutters and, at the same time, provide draught strip rubber or felt on the rebates.

Seats

- cmviii. The seats should be arranged in concentric arcs of circles drawn with the centre located as much behind the centre of the curtain line as its (curtain line) distance from the auditorium rear wall.
- cmix. The angle subtended with the horizontal at the front-most observer by the highest object should not exceed 30 degrees. On this basis, the distance of the front row works to about 3.6 m for drama and it should be 4.5 m or more for cinema purposes. Minimum distance of front seats should be determined by the highest point required to be seen on the stage which is usually raised by about 75 cm or more.
- cmx. The width of a seat should be between 45 cm and 56 cm.
- cmxi. The back to back distance of chairs in successive rows of seats shall be at least 85 cm. If extra comfort is required, higher spacing may be provided which shall vary between 85 cm and 106 cm.
- cmxii. Seats should be staggered sideways in relation to those in front so that a listener in any row is not looking directly over the head of the person in front of him.
- cmxiii. Upholstered seats shall be provided, wherever possible, so that the acoustic characteristics of the hall are, not appreciably affected by fluctuating audience occupancy. This is particularly important for halls where the audience provides the major part of the required sound absorption.

Reverberation Time

- cmxiv. The optimum reverberation time for a hall of particular volume may be chosen from the curves given in Fig. 8 depending on the function of the hall. These values are for a frequency of 500 cycles.
- cmxv. The number of absorption units required to give the desired reverberation time may be calculated according to Sabine's formula which is as follows:

$$A = 0.16 V / T$$

where

$A = \sum \alpha_n S_n$ = total sound absorption,

V = volume in m^3 ,

T = reverberation time in seconds,

α_n = absorption coefficient of the corresponding surface(s), and

S_n = individual area in m^2 corresponding to each value of α_n ,

- cmxvi. In order to estimate the quantity of absorption A , required, it is necessary to calculate the quantity of existing absorption A , provided by various surfaces, furnishings and two-thirds of the audience. This may be deducted from the total absorption A indicated by the formula given below:

$$A_1 = A - A_2$$

- cmxvii. The reverberation time varies at different frequencies. For the purpose of this code, it is enough to consider only one frequency as indicated in Fig. 8.

Distribution of Acoustic Material

- cmxviii. Reflecting surfaces shall be so designed as to aid distribution of sound. Those areas which cause objectionable sound reflection and need to be treated with sound absorbents should be earmarked for treatment with sound absorbing material. These areas are (a) the rear wall, (b) the balcony parapet, (c) any areas which may reflect sound back to the stage, (d) concave areas which have a tendency to focus sound in certain places, and (e) such other areas as will contribute to indirect sound arriving at any point in the hall later than 50 milliseconds after the direct sound. The rest of the sound absorbing material required to be introduced in the room should be distributed over the various remaining surfaces.

Sl. No.	DEFECT	CAUSES	RECOMMENDATION FOR	
			New Design	Existing Buildings
(1)	(2)	(3)	(4)	(5)
1	Excessive re- verberation	Insufficient ab- sorption	A d d a b s o r b e n t s	
2	Echoos	{ Unsuitable shape Remote reflecting surfaces	Avoid unsuitable shapes Make offending surface highly absor- bent	—
3	Sound foci	Concave reflecting interior surfaces	Avoid curvilinear interiors	Alter shape or use absorbents on focussing areas
4	Dead spots	Irregular distri- bution of sound	Provide even dif- fusion of sound	Introduce suit- able diffusers
5	Insufficient sound volume	{ Lack of reflec- tions close to source of sound Excessive absorption	Dispose hard reflecting surfaces about the source of sound	Adjust absorption to give optimum reverberation
6	Colouring of sound quality	{ Selective absorption Uncontrolled resonance	Use combination of absorbents to obtain uniform absorption coefficient over the required frequency range	Use wood panel absorbents which resonate over a wide frequency range and fix these on battens provided at irregular intervals. Adopt rigid con- struction with studs, etc
7	High back- ground noise	Poor sound in- sulation, badly fitting doors and windows or noisy air-conditioning system	Select construction with requisite sound insulation; provide proper fitting doors and windows with re- quisite sound insulation. Reduce noise from air-conditioning equipment by isolating the machine and/or treat- ment of plant room, etc	

Figure 8: Reverberation time at different frequencies

Sound absorbing Materials

cmxix. The materials generally used may be broadly classified into the following categories:

cmxx. In an average hall, most of the absorption is provided by the audience. This is relatively more in the high frequency range than in the middle or in the low frequency range. It, therefore, becomes desirable to introduce special low frequency absorbers (such as wooden paneling used as wainscot or otherwise) on ceilings and walls which will provide the requisite amount of absorption so as to achieve optimum reverberation time over as wide a frequency range as possible. The amount of the absorptive materials required should be calculated on the basis of the absorption values at one or more frequencies in each of the low, middle and high frequency regions namely 125, 500 and 2 000 c/s. The absorption coefficients for various materials are given in Appendices B and C.

Sound Amplification System

- cmxxi. A loudness of speech level of about 60 to 70 dB is required for comfortable listening and good intelligibility provided the ambient noise level is within the acceptable values given in 29.4 (1) (a). This level can be obtained in an acoustically well designed hall provided the volume does not exceed 1 400 m³ and the maximum distance from the speaker to listener is of the order of 23 m. Where background noise is high or the hall is large, a sound amplification system becomes necessary.

Additional Requirements for Open-Air Auditoriums and Conference Halls

- cmxxii. Open-Air Auditoriums - While the general considerations given in 29.4 (1) and 29.4 (1) (a) would apply to open-air auditoriums also, particular care should be taken in the case of open-air auditoriums as these are not enclosed. Prevailing noise conditions should not exceed 45 dB on 'A' scale. Wind velocities naturally experienced at site should not exceed 16 km/h.

Back stage wall should be made reflective and broken into convex shaped surfaces. Overall shape should be flat in plan; however, if it is desired to be concave, it should be broken into convex surfaces which in either case should be of at least 90 to 180 cm width.

Depth of stage should be arranged to suit individual requirements; where it exceeds 6 m, it is necessary to treat back stage wall acoustically. A ceiling reflector should be provided for directing the sound to the rear seats. This reflector may be a hard reflecting surface slanting at a suitable angle towards the audience and fixed over the main sound originating area of the stage.

If direction of wind generally remains the same, the auditorium should be so located that wind direction is towards the audience from the stage.

Even if reflectors are provided as recommended in (b) 29.4 (1) given above, sound amplification should be resorted to in case the number of audience exceeds 600 or back ground noise is more than 45 to 50 dB. The loudspeaker system should be so designed that it is capable of providing an average level up to 80 dB over the entire listening area.

- cmxxiii. Conference Halls - Basic difference between conference halls and auditoriums, like theatres and cinema halls, lies in the possibility of sound originating, in the former case from any part of the hall. In a conference hall a table or cluster of tables is generally placed in the centre of the hall, and persons who are listeners as well as speakers sit around the table. Conference halls may have any shape to suit architectural or any other special requirements. In designing conference halls particular consideration should, therefore, be given to the following requirements.

rrrrrrrrrr)Acoustics of the halls should be so designed as to ensure proper conditions for listening, assuming that a person may speak or listen from anywhere in the hall.

Optimum reverberation time should be chosen from Fig. 8 (speech). It may be noted that too long a reverberation time muffles and confuses the speech intelligibility while too short a time prevents build-up of proper Level for good listening.

Use of sound amplification system should be avoided as far as possible. But where necessitated, because of size or other requirements, low level loudspeakers or head phones should be provided for individual or a group of seats.

Absorbent material should be distributed evenly over the wall surfaces of the hall.

Ceiling should not be domed and should not be 'higher than 6 metres. Acoustical treatment on the ceiling should be confined to peripheral regions only. In the case of larger halls with considerable heights, more area of ceiling would need to be treated.

General Design Considerations -

Walls

cmxxiv. The walls are constructed with shear wall technology and the thickness considered is as per design

cmxxv. 160mm thickness for external walls and 110mm thickness for internal walls.

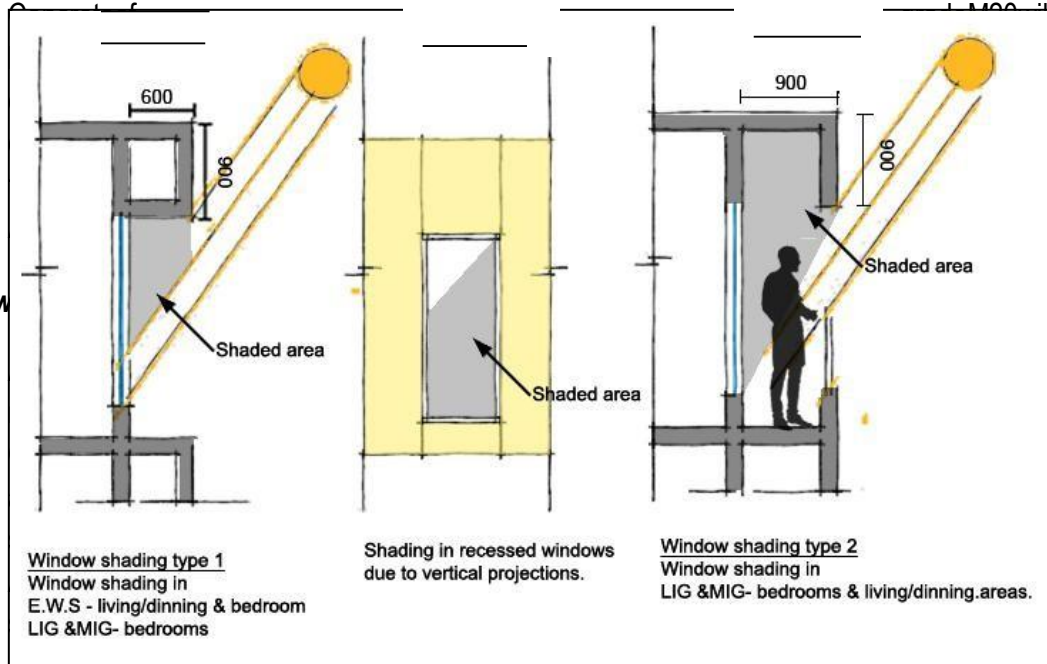
cmxxvi. Thermal storage capacity increase is directly proportional to the compactness, density, and specific heat capacity of the material. Lower the building mass lower the thermal storage capacity.

cmxxvii.
Window

cmxxviii.

cmxxix.

cmxxx.



Horizontal projection

Vertical projection

Balcony

Projection

PART II: EMPLOYER'S REQUIREMENTS

Supplementary Information

1. Co-operation: The Contractor shall establish full co-ordination with the officials of Employer/GSCDL, extend co-operation to complete work.
2. Records procedures and reports: A work order book shall be maintained by the contractor at site/workshop for taking instructions from employer or his representative. The Contractor shall maintain records pertaining to the quality of installation / erection work and inspection, testing, compliance with all technical requirements in respect of all this works as described before. The Contractor shall submit such records to the Employer after the completion of any particular work before submitting the bill.
3. Personnel:-The contractor shall depute sufficient staff to carry out installation, the maintenance and repair work efficiently and satisfactorily. The Contractor shall undertake to comply with applicable legislation and the code of labour law on matters of health, hygiene and safety, and shall assume responsibility for works required in the event of any change in applicable regulations. The contractor shall provide all necessary superintendence during the execution of works and during maintenance. The Contractor's staff shall include adequate and competent persons with proven suitable, previous experience on similar contracts to supervise the works and sufficient skilled, semi-skilled and unskilled labour to ensure completion of works in time. The Contractor shall not remove any representative or skilled labour from the site without prior approval of the Employer's Representative for the proper fulfilling of the contractors obligations under the contract. The contractor or a competent and authorized agent or representative approved in writing by Employer on the basis of qualification and experience to be furnished by the contractor, which approval may at any time be withdrawn, is to be constantly on the works and shall give his whole time to the superintendence of the work.
4. Public Authorities: - The Contractor shall comply with all rules & regulations, bye laws and directives given from time to time by any local or public authority in connection with this work and shall himself pay fees or charges which shall be levied on him without any extra cost.
5. Safety:-The Contractor will be responsible for safety of the material supplied and kept in joint custody of the employer and the contractor till completion of contract. The Contractor shall at his own expense arrange for the safety of his labour / supervisor staff employed by him directly or indirectly for performing the work, as per statutory requirement. The Contractor shall report any accident or unusual occurrence with the work at site that take place to employer immediately with the action, which he might have taken.
6. Acquaintance with Site and Work Conditions: - The Bidder shall study the site and general conditions in respect of approaches, labourers, climate and the data included in the tender documents and get it verified with actual inspections of the site, before submitting the tender. In case of doubt about any item or data included in the tender, the same shall be got clarified in pre-bid meeting. Once the tender is accepted, it shall be concluded that the Contractor has verified and made himself conversant with all the details required for completing the work as stipulated conditions and specifications.

APPENDIX

APPENDIX A

SUMMARY OF COMMON ACOUSTICAL DEFECTS IN AUDITORIUMS AND CONFERENHALLSAND RECOMMENDED REMEDIES FOR THE SAME

Sl. No.	DEFECT	CAUSES	RECOMMENDATION FOR	
			New Design	Existing Buildings
(1)	(2)	(3)	(4)	(5)
1	Excessive re- verberation	Insufficient ab- sorption	Add absorbents	
2	Echoos	<ul style="list-style-type: none"> Unsuitable shape Remote reflecting surfaces 	<ul style="list-style-type: none"> Avoid unsuitable shapes Make offending surface highly absor- bent 	—
3	Sound foci	Concave reflecting interior surfaces	Avoid curvilinear interiors	Alter shape or use absorbents on focussing areas
4	Dead spots	Irregular distri- bution of sound	Provide even dif- fusion of sound	Introduce suit- able diffusers
5	Insufficient sound volume	<ul style="list-style-type: none"> Lack of reflec- tions close to source of sound Excessive absorption 	<ul style="list-style-type: none"> Dispose hard reflecting surfaces about the source of sound Adjust absorption to give optimum reverberation 	
6	Colouring of sound quality	<ul style="list-style-type: none"> Selective absorption Uncontrolled resonance 	<ul style="list-style-type: none"> Use combination of absorbents to obtain uniform absorption coefficient over the required frequency range Use wood panel absorbents which resonate over a wide frequency range and fix these on battens provided at irregular intervals. Adopt rigid con- struction with studs, etc 	
7	High back- ground noise	Poor sound in- sulation, badly fitting doors and windows or noisy air-conditioning system	Select construction with requisite sound insulation; provide proper fitting doors and windows with re- quisite sound insulation. Reduce noise from air-conditioning equipment by isolating the machine and/or treat- ment of plant room, etc	

APPENDIX B

ABSORPTION COEFFICIENTS FOR BUILDING MATERIALS AND FURNISHINGS

Sl. No.	MATERIAL	ABSORPTION COEFFICIENT AT		
		125 c/s	500 c/s	2 000 c/s
<i>Hangings and Floorings</i>				
1	Carpet, lined	0.10	0.25	0.40
2	Carpets, unlined	0.08	0.15	0.25
3	Cotton fabric, 475 g/m ² draped to half its area	0.07	0.49	0.66
4	Draperies, velours 610 g/m ²	0.05	0.35	0.38
5	Draperies, as above draped to half their area	0.14	0.55	0.70
6	Stage curtain	0.19	0.20	0.23
7	Linoleum or concrete floor	0.02	0.03	0.04
8	Floor, wood on solid	0.12	0.09	0.09
9	Floor, wood boards on timber frame	0.25	0.13	0.15
<i>Masonry and Building Material</i>				
10	Brick wall 40 cm thick	0.02	0.03	0.05
11	Plaster in wall	0.03	0.02	0.04
12	Ceiling, 50 mm plaster of Paris suspended from trusses	0.08	0.05	0.04
13	Plyboard on 75 mm air space	0.30	0.10	0.05
14	Wood veneer 10 mm thick on 50 × 75 mm wood studs at 40 cm centre to centre	0.11	0.12	0.10
15	Glass against solid surface	0.03	0.03	0.02
16	Marble	0.01	0.01	0.01
<i>Audience, Chairs, etc</i>				
17	Audience seated in fully upholstered seats (per person)	0.18	0.46	0.51
18	Chair, upholstered seat with spring	—	0.16	0.071
19	Seats (unoccupied) fully upholstered (per seat)	0.16	0.40	0.44

APPENDIX C

ABSORPTION COEFFICIENTS OF INDIGENOUS ACOUSTICAL MATERIALS

Sl No.	MATERIAL	THICK- NESS mm	DEN- SITY g/cm ³	ABSORPTION COEFFICIENT AT			
				125 c/s	500 c/s	2 000 c/s	4 000 c/s
1	Fibrous (acoustic) plaster	20	0.1	—	0.30	0.50	—
2	Compressed fibre board:						
	a) Unperforated	12	—	0.24	0.3	0.2	0.24
	b) Perforated uniformly over part depth (rigid backing)	12.7	0.3	0.06	0.55	0.67	0.70
	c) Perforated randomly over part depth (rigid backing)	12.7	0.3	0.15	0.52	0.76	0.58
3	Compressed wood particle board						
	a) Perforated (rigid backing)	12.7	0.37	0.04	0.36	0.78	0.99
	b) Perforated (rigid backing)	19.1	0.34	0.05	0.61	0.91	0.96
	c) Perforated and painted (rigid backing)	12.7	0.40	0.05	0.40	0.82	0.59
	d) Perforated and painted (rigid backing)	19.1	0.38	0.10	0.62	0.74	0.69
4	a) Wood wool board	25	0.4	—	0.20	0.60	—
	b) Wood wool board (50 mm from wall)	25	0.4	—	0.35	0.35	—
5	Mineral glass wool quilts and mats	25	0.06	0.09	0.17	0.50	—
6	Bonded & compressed mineral/ glass wool tiles	50	0.04	0.12	0.26	0.44	0.8
7	Composite units of perforated hardboard backed by perforated fibre board	25	0.4	0.25	0.5	0.65	—
8	a) Mineral/glass wool with scrim mat (rigid backing)	25	0.08	0.29	0.85	0.84	0.98
	b) Mineral/glass wool with scrim mat (rigid backing)	50	0.08	0.57	0.99	0.95	0.99
	c) Mineral/glass wool with scrim mat faced with perforated (10% open area) hardboard (rigid backing)	25	0.08	0.06	0.99	0.49	0.31
	d) Mineral/glass wool with scrim mat faced with perforated (10% open area) hardboard (rigid backing)	50	0.08	0.20	0.99	0.61	0.42

PART II: EMPLOYER'S REQUIREMENTS

Sl. No.	MATERIAL	THICKNESS mm	DENSITY g/cm ³	ABSORPTION COEFFICIENT AT			
				125 c/s	500 c/s	2 000 c/s	4 000 c/s
9	Miscellaneous:						
	a) Strawboard	13	0.24	—	0.30	0.35	—
	b) Strawboard spaced 50 mm from wall	13	0.24	—	0.35	0.30	—
	c) Composite panel 5 mm perforated plywood 50 mm mineral wool and 22 mm cement asbestos (suspended from trusses)	—	—	0.36	0.95	0.67	—
	d) Composite panel 5 mm perforated plywood 50 mm mineral wool and 22 mm hardboard (suspended from trusses)	—	—	0.47	0.20	0.09	—

NOTE — The absorption coefficients of materials given in items 2(b), 2(c), 3(a) to 3(d) and 8(a) to 8(d) are based on tests made at the Central Building Research Institute, Roorkee.

6E Terms & Procedure of Payment

- In accordance with the provisions of GCC Clauses 39 and 40, the Employer shall pay the Contractor in the manner and at the times set out in this Terms and Procedures of Payment Schedule. As per the schedule given below the Employer shall subject to provisions of Clause 5 of this section, no later than 28 days after the receipt of Engineers in Charge statement by the Employer.
- Item wise breakup of the payment schedule**

Sr. No	Particulars	Performance Level of work	% of payment allowed
1	Design and construction of main building block	1. Submission of all designs including structural, elevations, electrical, plumbing etc. complete and after approval from the Engineer in Charge	5%
		2. Completion of foundation & masonry work up to plinth including site preparedness and protective works	15%
		3. On completion of RCC frame of columns, beams, staircase and slab	20%
		4. On completion of walls, with plastering inside and outside	15%
		5. On completion of flooring, erection of doors/ windows/ ventilators/ grills, painting inside & outside and all civil works complete	15%
		6. On completion of all electrical works including wiring, installation of switches, fixtures etc. complete including external electrical works	5%
		7. On completion of plumbing works including water supply to the building, waste water sewerage lines upto the point of disposal etc. complete.	5%
		8. On completion of Elevation and paintings etc complete	20%
		4. On completion of walls, with plastering inside and outside	10%
		5. On completion of flooring, erection of doors/ windows/ ventilators/ grills, painting inside & outside and all civil works complete	10%
6. On completion of all electrical works including wiring, installation of switches, fixtures etc. complete including external electrical works	5%		
2	Development of Arrival Areas, Interpretation areas, road development	1.Submission of all designs including structural, elevations, layout plan etc. complete and after approval from the Project Manager	10 %

PART II: EMPLOYER'S REQUIREMENTS

Sr. No	Particulars	Performance Level of work	% of payment allowed
	and site stabilization	2.Site Preparation and development of site, 40% completion of work of gate	20%
		3. Completion of all works pertaining to arrival area, Interpretation areas as per approved designs & as per satisfaction of Project Manager complete in all respects.	70%
3	Development of Boundary fencing	1.Submission of layout plan etc. complete and after approval from the Project Manager	10%
		2. Completion of 40% of the boundary fencing work	40%
		3. Completion of all100% boundary fencing works as per approved designs & as per satisfaction of Project Manager complete in all respects.	50%
4	Landscape design	1.Submission of all designs including structural, elevations, layout plan etc. complete and after approval from the Project Manager	10%
		2.Site leveling and preparation of planting beds and pathways	30%
		3. Planting of shrubs and plants and installation of landscape elements	50%
		4.Completion of all works as per approved designs & as per satisfaction of Project Manager complete in all respects.	10%
5	Sound & Security system	1.Submission of design scheme and concept for the sound and security systems after approval from the Project Manager	10%
		2. Installation and fixing based on approved scheme on site	50%
		3.Testing and commissioning of all the installed system as per the approved designs & as per the satisfaction of Project Manager	40%
6	Rainwater harvesting and Renewable energy	1.Submission of design scheme and concept for the sound and security systems after approval from the Project Manager	10%
		2.Site Preparation and development of site, 40% completion of work of Rain Water Harvesting & other allied works for this section as per approved designs by Project Manager	20%
		3.Completion of Pit work with connections of all	30%

PART II: EMPLOYER'S REQUIREMENTS

Sr. No	Particulars	Performance Level of work	% of payment allowed
		drains/channels with pits of Rain Water Harvesting and other allied works for this section as per approved designs by Project Manager	
		4. Testing and commissioning of the installed system as per the approved designs & as per the satisfaction of Project Manager	40%
7	External/ Common areas Services (Provision for External Water Supply, Sanitation and Electrification)	1. Submission of design scheme and approval from the Project Manager	10%
		2. Supply of approved material on site.	40%
		3. Erection and installation of all Electrical, water supply and waste water system in common areas	30%
		4. Testing and commissioning of the services installed as per the approved designs & as per the satisfaction of Project Manager	20%

3. The amounts to be paid to the Operator in accordance with Clause 2 of this Terms and Procedures of Payment Section shall include all costs and expenses of the contractor in building the structures.
4. The amounts paid to the Operator in accordance with Clause 2 of this Terms and Procedures of Payment Section shall be repaid to the Contractor as part of the payments set out in Clause 2 of this section by reducing those payments by an amount equal to the advance payment times the same percentage of the Contract Amount that the Engineer in Charge determines in accordance with Clause 2 of this Terms and Procedures of Payment Section.
5. The Employer shall deduct from each payment to the Contractor pursuant to Clause 2 this Term and Procedures of Payment Section, a Retention in the amount of 10 per cent of each payment to the Contractor.

The Retention amount may be released to the Contractor subject to the Operator furnishing an irrevocable Bank Guarantee from the nationalized Bank equivalent to the Retention amount. The Employer shall pay the 100 per cent of the Retention amount back to the Contractor after the expiry of Defects Liability Period

6D Supplementary Information

1. Co-operation: The Contractor shall establish full co-ordination with the officials of Employer/GSCDL, extend co-operation to complete work.
2. Records procedures and reports: A work order book shall be maintained by the contractor at site/workshop for taking instructions from employer or his representative. The Contractor shall

PART II: EMPLOYER'S REQUIREMENTS

maintain records pertaining to the quality of installation / erection work and inspection, testing, compliance with all technical requirements in respect of all this works as described before. The Contractor shall submit such records to the Employer after the completion of any particular work before submitting the bill.

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PART III

CONDITIONS OF CONTRACT AND CONTRACT FORMS

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Section 7 - GENERAL DIRECTIONS AND CONDITIONS OF CONTRACT

A. General

1. Definitions

- 1.1. Boldface type is used to identify defined terms.
- (a) The **Accepted Contract Amount** means the amount accepted in the Letter of Acceptance for the execution and completion of the Works and the remedying of any defects.
 - (b) The **Activity Schedule** is a schedule of the activities comprising the construction, installation, testing, and commissioning of the Works in a lump sum contract. It includes a lump sum price for each activity, which is used for valuations and for assessing the effects of Variations and Compensation Events.
 - (c) The **Adjudicator** is the person appointed jointly by the Employer and the Contractor to resolve disputes in the first instance, as provided for in GCC 23.1 hereunder.
 - (d) **Bill of Quantities** means the priced and completed Bill of Quantities forming part of the Bid.
 - (e) **Compensation Events** are those defined in GCC 41.1 hereunder.
 - (f) The **Completion Date** is the date of completion of the Works as certified by the Project Manager, in accordance with GCC 52.1.
 - (g) The **Contract** is the Contract between the Employer and the Contractor to execute, complete, and maintain the Works. It consists of the documents listed in GCC 2.3 below.
 - (h) The **Contractor** is the party whose Bid to carry out the Works has been accepted by the Employer.
 - (i) The **Contractor's Bid** is the completed bidding document submitted by the Contractor to the Employer.
 - (j) The **Contract Price** is the Accepted Contract Amount stated in the Letter of Acceptance and thereafter as adjusted in accordance with the Contract.
 - (k) **Days** are calendar days; months are calendar months.
 - (l) **Day works** are varied work inputs subject to payment on a time basis for the Contractor's employees and Equipment, in addition to payments for associated Materials and Plant.

PART III: CONDITIONS OF CONTRACT AND CONTRACT FORMS

- (m) A **Defect** is any part of the Works not completed in accordance with the Contract.
- (n) The **Defects Liability Certificate** is the certificate issued by Project Manager upon correction of defects by the Contractor.
- (o) The **Defects Liability Period** is the period calculated from the Completion Date where the Contractor remains responsible for remedying defects.
- (p) **Drawings** include calculations and other information provided or approved by the Project Manager for the execution of the Contract.
- (q) The **Employer** is the party who employs the Contractor to carry out the Works, as specified in the **PCC**.
- (r) **Equipment** is the Contractor's machinery and vehicles brought temporarily to the Site to construct the Works.
- (s) **Force Majeure** means an exceptional event or circumstance: which is beyond a Party's control; which such Party could not reasonably have provided against before entering into the Contract; which, having arisen, such Party could not reasonably have avoided or overcome; and, which is not substantially attributable to the other Party.
- (t) The **Initial Contract Price** is the Contract Price listed in the Employer's Letter of Acceptance.
- (u) The **Intended Completion Date** is the date on which it is intended that the Contractor shall complete the Works. The Intended Completion Date is specified in the **PCC**. The Intended Completion Date may be revised only by the Project Manager by issuing an extension of time or an acceleration order.
- (v) **Letter of Acceptance** means the formal acceptance by the Employer of the Bid and denotes the formation of the Contract at the date of acceptance.
- (w) **Materials** are all supplies, including consumables, used by the Contractor for incorporation in the Works.
- (x) "**Party**" means the Employer or the Contractor, as the context requires.
- (y) **PCC** means Particular Conditions of Contract
- (z) **Plant** is any integral part of the Works that shall have a mechanical, electrical, chemical, or biological function.
- (aa) The **Project Manager** is the person named in the **PCC** (or any other competent person appointed by the Employer and notified to the Contractor, to act in replacement of the Project Manager) who is responsible for supervising the execution of the Works and administering the Contract.

PART III: CONDITIONS OF CONTRACT AND CONTRACT FORMS

- (bb) **Retention Money** means the aggregate of all monies retained by the Employer pursuant to GCC 45.1.
- (cc) The **Site** is the area defined as such in the **PCC**.
- (dd) **Site Investigation Reports** are those that were included in the bidding documents and are factual and interpretative reports about the surface and subsurface conditions at the Site.
- (ee) **Specification** means the Specification of the Works included in the Contract and any modification or addition made or approved by the Project Manager.
- (ff) The **Start Date** is given in the **PCC**. It is the latest date when the Contractor shall commence execution of the Works. It does not necessarily coincide with any of the Site Possession Dates.
- (gg) A **Subcontractor** is a person or corporate body who has a Contract with the Contractor to carry out a part of the work in the Contract, which includes work on the Site.
- (hh) **Temporary Works** are works designed, constructed, installed, and removed by the Contractor that are needed for construction or installation of the Works.
- (ii) A **Variation** is an instruction given by the Project Manager which varies the Works.
- (jj) The **Works** are what the Contract requires the Contractor to construct, install, and turn over to the Employer, as defined in the **PCC**.
- (kk) The **Certificate of Completion** is the Certificate issued by the Project Manager to the Contractor, on successful completion of all the works specified in the Works Requirement (Section 6) and is "fit for purpose".

2. Interpretation

- 2.1. In interpreting these GCC, singular also means plural, male also means female or neuter, and the other way around. Headings have no significance. Words have their normal meaning under the language of the Contract unless specifically defined. The Project Manager shall provide instructions clarifying queries about these GCC.
- 2.2. If sectional completion is specified in the PCC, references in the GCC to the Works, the Completion Date, and the Intended Completion Date apply to any Section of the Works (other than references to the Completion Date and Intended Completion Date for the whole of the Works).
- 2.3. The documents forming the Contract shall be interpreted in the following order of priority:
 - a) Agreement,

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- b) Letter of Acceptance,
- c) Particular Conditions of Contract,
- d) General Conditions of Contract,
- e) Specifications,
- f) Drawings,
- g) Bill of Quantities (or Schedules of Prices for lump sum contracts), and
- h) Contractor's Bid,
- i) any other document listed in the PCC as forming part of the Contract.

3. *Language and Law*

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

4. *Project Manager's Decisions*

4.1. Except where otherwise specifically stated, the Project Manager shall decide contractual matters between the Employer and the Contractor in the role representing the Employer.

5. *Delegation*

5.1. The Project Manager may delegate any of his duties and responsibilities to other people except to the Adjudicator, after notifying the Contractor, and may cancel any delegation after notifying the Contractor.

6. *Communications*

6.1. Communications between parties that are referred to in the Conditions shall be effective only when in writing. A notice shall be effective only when it is delivered

7. *Subcontracting*

7.1. The Contractor may subcontract with the approval of the Project Manager, but may not assign the Contract without the approval of the Employer in writing. Subcontracting shall not alter the Contractor's obligations.

8. *Other Contractors*

8.1. The Contractor shall cooperate and share the Site with other contractors, public authorities, utilities, and the Employer between the dates given in the Schedule of Other Contractors, as referred to in the PCC. The Contractor shall also provide facilities and services for them as described in the Schedule. The Employer may modify the Schedule of other Contractors, and shall notify the Contractor of any such modification.

9. Personnel and Equipment

- 9.1. The Contractor shall employ the key personnel and use the equipment identified in its Bid to carry out the Works, or other personnel and equipment approved by the Project Manager. The Project Manager shall approve any proposed replacement of key personnel and equipment only if their relevant qualifications or characteristics are substantially equal to or better than those proposed in the Bid.
- 9.2. If the Project Manager asks the Contractor to remove a person who is a member of the Contractor's staff or work force, stating the reasons, the Contractor shall ensure that the person leaves the Site within seven days and has no further connection with the work in the Contract.

10. Employer's and Contractor's Risks

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

11. Employer's Risks

- 11.1. From the Start Date until the Defects Liability Certificate has been issued, the following are Employer's risks:
- (a) The risk of personal injury, death, or loss of or damage to property (excluding the Works, Plant, Materials, and Equipment), which are due to
 - (i) use or occupation of the Site by the Works or for the purpose of the Works, which is the unavoidable result of the Works or
 - (ii) negligence, breach of statutory duty, or interference with any legal right by the Employer or by any person employed by or contracted to him except the Contractor.
 - (b) The risk of damage to the Works, Plant, Materials, and Equipment to the extent that it is due to a fault of the Employer or in the Employer's design, or due to war or radioactive contamination directly affecting the country where the Works are to be executed.
- 11.2. From the Completion Date until the Defects Liability Certificate has been issued, the risk of loss of or damage to the Works, Plant, and Materials is an Employer's risk except loss or damage due to
- (a) a Defect which existed on the Completion Date,
 - (b) an event occurring before the Completion Date, which was not itself an Employer's risk, or
 - (c) the activities of the Contractor on the Site after the Completion Date.

12. Contractor's Risks

- 12.1. From the Starting Date until the Defects Liability Certificate has been issued, the risks of personal injury, death, and loss of or damage to property (including, without

limitation, the Works, Plant, Materials, and Equipment) which are not Employer's risks are Contractor's risks.

13. Insurance

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

- (a) loss of or damage to the Works, Plant, and Materials;
- (b) loss of or damage to Equipment;
- (c) loss of or damage to property (except the Works, Plant, Materials, and Equipment) in connection with the Contract; and
- (d) personal injury or death.

13.1.1. Insurance of work and contractor's equipment: The Contractor shall, without limiting his or the Employer's obligations and responsibilities under Clause GCC 11, insure:

- (a) the Works, together with materials and Plant for incorporation therein to the full replacement cost
- (b) additional sum as required by the employer, detailed out in the PCC.
- (c) the Contractor's Equipment and other things brought onto the Site by the Contractor, for a sum sufficient to provide for their replacement at the Site.

13.1.2. Scope of cover: The insurance in paragraphs (a) and (b) of Sub-Clause 13.1.1 shall be in the joint names of the Contractor and the Employer and shall cover:

- (a) the Employer and the Contractor against all loss or damage from whatsoever cause arising, other than as provided Sub-Clause 13.1.4, from the first working day after the commencement date until the date of issue of the relevant Taking-Over Certificate in respect of the Works or any Section or part thereof as the case may be, and
- (b) the Contractor for his liability;
 - (i) during the Defects Liability Period for loss or damage arising from a cause occurring prior to the commencement of the Defects Liability Period, and
 - (ii) for loss or damage occasioned by the Contractor in the course of any operations carried out by him for the purpose of complying with his obligations under Clause GCC 33.

13.1.3. Responsibility for Amount not Recovered: Any amounts not insured or not recovered from the insurers shall be borne by the Employer or the Contractor in accordance with their responsibilities Clause GCC 11 & 12.

13.1.4. Exclusions: There shall be no obligation for the insurance in Sub-Clause 13.1.1 to include loss or damage caused by

- (a) war, hostilities, invasion, and act of foreign enemies.

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(b) Rebellion, revolution, insurrection or military or usurped power, or civil war.

13.1.5. Third Party Insurance: The Contractor shall, without limiting his or the Employer's obligations and responsibilities under Clause GCC 63, insure, in the joint names of the Contractor and the Employer, against liabilities for death of or injury to any person (other than as provided in sub-clause 13.1.6 and 13.1.7) or loss or damage to any property (other than the Works) arising out of the performance of the Contract, other than the exception defined in paragraphs (a), (b) and(c) of clause GCC 63.3

Such insurance shall be for a certain minimum percentage of the contract amount as specified in the PCC.

The insurance policy shall include a cross liability clause such that the insurance shall apply to the Contractor and to the Employer as separate insured.

13.1.6. Insurance for Employers Staff: The Contractor shall also, without limiting his or the employer's obligations insure in the Joint names of the contractor and the Employer, the Employer's staff to extent of 5 numbers and their staff engaged on the works at the site against liabilities for death or injury. The amount for the insurance cover for each of the employer's staff so engaged shall be limited to a minimum of Rs. 3,00,000/- per person or as per the laws governing in state whichever is more. The insurance shall continue until the taking over certificate for the whole of the works is issued. Notwithstanding the amount mentioned above, insurance obtained should satisfy the prevailing rules in this regard.

13.1.7 Accident or Injury to Workmen: The Employer or its representatives shall not be liable for or in respect of any damages or compensation payable to any workman or other person in the employment of the Contractor or any subcontractor, other than death or injury resulting from any act or default or the Employer, his agents or servants. The Contractor shall indemnify and keep indemnified the Employer against all such damages and compensation, other than those for which the Employer is liable as aforesaid, and against all claims, proceedings, damages, costs, charges, and expenses whatsoever in respect thereof or in relation thereto.

The Contractor shall insure against such liability and shall continue such insurance during the whole time that any person is employed by him on the Works. Provided that, in respect of any persons employed by any Subcontractor, the Contractor's obligations to insure as aforesaid under the Sub-Clause shall be satisfied if the Subcontractor shall have insured against the liability in respect of such persons in such manner that the Employer is indemnified under the policy, but the Contractor shall require such Subcontractor to produce to the Employer, when required, such policy of insurance and the receipt for the payment of the current premium.

13.1.8 Personal Accident Insurance: In addition to any other insurance required to be taken out by statutory requirements (e.g. Workmen's

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Compensation Act 1923), the Contractor shall take out a Personal Accident Insurance in favour of each workman employed by him on the Works. Provided that, in respect of any persons employed by any Sub-Contractor, the Contractor's obligations to insure as aforesaid under this Sub-Clause shall be satisfied if the Sub-Contractor shall have taken out Personal Accident Insurance in respect of his workmen employed on the works and the Contractor shall require such Sub-Contractor to produce to the Employer, when required, such policy of Personal Accident Insurance and the receipt for the payment of the current premium.

13.1.9 Evidence and Terms of Insurances: The Contractor shall provide evidence to the Employer as soon as practicable after the respective insurance have been taken out but in any case prior to the start of work at the Site that the insurances required under the Contract have been effected and shall, within 84 days of the Commencement Date, provide the insurance policies to the Employer. When providing such evidence and such policies to the Employer, the Contractor shall notify the Project Manager of so doing. Such insurance policies shall be consistent with the general terms agreed prior to the issue of the Letter of Acceptance. The Contractor shall effect all insurances for which he is responsible with insurers and in terms approved by the Employer.

13.1.10 Adequacy of Insurance: The Contractor shall notify the insurers of changes in the nature, extent or programme for the execution of the Works and ensure the adequacy of the insurances at all times in accordance with the terms of the Contract and shall, when required, produce to the Employer the insurance policies in force and the receipts for payment of the current premium.

13.1.11 Remedy on Contractor's failure to Insure: If the Contractor fails to effect and to keep in force any of the insurances required under the Contract, or fails to provide the policies to the Employer within the period required by Clause 13.1.9, then and in any such case the Employer may effect and keep in force any such insurances and pay any premium as may be necessary for that purpose and from time to time and deduct premium amount so paid from any monies due or to become due to the Contractor, or recover the same as a debt due from the Contractor.

- 13.2 Policies and certificates for insurance shall be delivered by the Contractor to the Project Manager for the Project Manager's approval before the Start Date. All such insurance shall provide for compensation to be payable in the types and proportions of currencies required to rectify the loss or damage incurred.
- 13.3 If the Contractor does not provide any of the policies and certificates required, the Employer may affect the insurance which the Contractor should have provided and recover the premiums the Employer has paid from payments otherwise due to the Contractor or, if no payment is due, the payment of the premiums shall be a debt due.

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- 13.4 Alterations to the terms of insurance shall not be made without the approval of the Project Manager.
- 13.5 Both parties shall comply with any conditions of the insurance policies.

14. Site Investigation Reports

- 14.1. The Contractor, in preparing the Bid, shall rely on any Site Investigation Reports referred to in the PCC, supplemented by any information available to the Bidder.

15. Contractor to Construct the Works

- 15.1. The Contractor shall construct and install the Works in accordance with the Specifications and Drawings as specified in Section 6.

16. The Works to Be Completed by the Intended Completion Date

- 16.1. The Contractor may commence execution of the Works on the Start Date and shall carry out the Works in accordance with the Program submitted by the Contractor, as updated with the approval of the Project Manager, and complete them by the Intended Completion Date.

17. Designs by Contractor and Approval by the Project Manager

- 17.1. The Contractor shall carry out design to the extent specified in the PCC. The Contractor shall promptly submit to the Employer all designs prepared by him. Within 14 days of receipt, the Employer shall notify any comments. The Contractor shall not construct any element of the permanent work designed by him within 14 days after the design has been submitted to the Employer or where the design for that element has been rejected. Design that has been rejected shall be promptly amended and resubmitted. The Contractor shall resubmit all designs commented on taking these comments into account as necessary.
- 17.2. The Contractor shall be responsible for design of Temporary Works.
- 17.3. The Contractor shall submit Specifications and Drawings showing the proposed Temporary Works to the Project Manager, who is to approve them if they comply with the Specifications and Drawings.
- 17.4. The Project Manager's approval shall not alter the Contractor's responsibility for design of the Temporary Works.
- 17.5. The Contractor shall obtain approval of third parties to the design of the Temporary Works, where required.
- 17.6. All Drawings prepared by the Contractor for the execution of the temporary or permanent Works, are subject to prior approval by the Project Manager before this use.

18. Safety

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

19. Discoveries

19.1. Anything of historical or other interest or of significant value unexpectedly discovered on the Site shall be the property of the Employer. The Contractor shall notify the Project Manager of such discoveries and carry out the Project Manager's instructions for dealing with them.

All old curiosities, relic coins, minerals etc., found in the excavation or pulling down shall be the property of the Government. Should any ancient masonry or other old work of interest be opened up, or any religious edifice or relic be involved in removal or destruction, in the execution of a work, a clear report on the matter should be sent to Government through the Employer and orders obtained before the demolition or removal of such works or relics. Similarly, regarding old curiosities etc., obtained during excavation, the Project Manager should consult the District Collector through appropriate channel regarding disposal of the same.

20. Possession of the Site

20.1 The Employer shall give possession of all parts of the Site to the Contractor. If possession of a part is not given by the date stated in the PCC, the Employer shall be deemed to have delayed the start of the relevant activities, and this shall be a Compensation Event. The final authority on this matter shall lie with the GSCDL and decision in this matter taken by GSCDL will be binding on all parties to this contract.

21. Access to the Site

21.1. The Contractor shall allow the Project Manager and any person authorized by the Project Manager access to the Site and to any place where work in connection with the Contract is being carried out or is intended to be carried out.

22. Instructions, Inspections and Audits

22.1. The Contractor shall carry out all instructions of the Project Manager which comply with the applicable laws where the Site is located.

22.2. The Contractor shall permit the GSCDL to inspect the Contractor's accounts, records and other documents relating to the submission of bids and contract performance and to have them audited by auditors appointed by the GSCDL. The Contractor shall maintain all documents and records related to the Contract for a period of three (3) years after completion of the Works. The Contractor shall provide any documents necessary for the investigation of allegations of fraud, collusion, coercion, or corruption and require its employees or agents with knowledge of the Contract to respond to questions from the GSCDL.

23. Appointment of the Adjudicator

23.1. The Adjudicator shall be appointed jointly by the Employer and the Contractor, at the time of the Employer's issuance of the Letter of Acceptance. If, in the Letter of

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Acceptance, the Employer does not agree on the appointment of the Adjudicator, the Employer will request the Appointing Authority designated in the PCC, to appoint the Adjudicator within 14 days of receipt of such request.

- 23.2. Should the Adjudicator resign or die, or should the Employer and the Contractor agree that the Adjudicator is not functioning in accordance with the provisions of the Contract; a new Adjudicator shall be jointly appointed by the Employer and the Contractor. In case of disagreement between the Employer and the Contractor, within 30 days, the Adjudicator shall be designated by the Appointing Authority at the request of either party, within 14 days of receipt of such request.

24. Procedure for Disputes

- 24.1. Void.
- 24.2. Void.
- 24.3. Any disputes between the Employer and the Contractor arising out of or in connection with the Contract not settled amicably and in respect of Project Manager's decision, arbitration shall be conducted in accordance with the Arbitration and Conciliation Act 1996 with relevant amendments.
- 24.4. The seat and place of the arbitration shall be Gangtok, Sikkim. Arbitration shall be held by a three-member Arbitration team. For the Panel, the Employer and the Contractor will suggest an Arbitrator each within 14 days of receipt of Arbitration Notice. The two Arbitrators will then mutually decide upon the Third Arbitrator.

B. Time Control

25. Program

- 25.1. The Contractor shall submit for approval a Program for the Works within 14 days from the date of the Letter of Acceptance. Within this, the Contractor shall submit to the Project Manager for approval a Program showing the general methods, arrangements, order, and timing for all the activities in the Works. In the case of a lump sum contract, the activities in the Program shall be consistent with those in the Activity Schedule.
- 25.2. An update of the Program shall be a program showing the actual progress achieved on each activity and the effect of the progress achieved on the timing of the remaining work, including any changes to the sequence of the activities.
- 25.3. The Contractor shall submit to the Project Manager for approval an updated Program at intervals no longer than the period of 30 days. If the Contractor does not submit an updated Program within this period, the Project Manager may withhold the amount stated in the PCC from the next payment certificate and continue to withhold this amount until the next payment after the date on which the overdue Program has been submitted. In the case of a lump sum contract, the Contractor shall provide an updated Activity Schedule within 14 days of being instructed to by the Project Manager.
- 25.4. The Project Manager's approval of the Program shall not alter the Contractor's obligations. The Contractor may revise the Program and submit it to the Project

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Manager again at any time. A revised Program shall show the effect of Variations and Compensation Events.

26. Extension of the Intended Completion Date

- 26.1. The Project Manager shall extend the Intended Completion Date if a Compensation Event occurs or a Variation is issued which makes it impossible for Completion to be achieved by the Intended Completion Date without the Contractor taking steps to accelerate the remaining work, which would cause the Contractor to incur additional cost.
- 26.2. The Project Manager shall decide whether and by how much to extend the Intended Completion Date within 21 days of the Contractor asking the Project Manager for a decision upon the effect of a Compensation Event or Variation and submitting full supporting information. If the Contractor has failed to give early warning of a delay or has failed to cooperate in dealing with a delay, the delay by this failure shall not be considered in assessing the new Intended Completion Date.

27. Acceleration

- 27.1. When the Employer wants the Contractor to complete works before the Intended Completion Date, the Project Manager appointed by employer shall obtain priced proposals for achieving the necessary acceleration of works from the Contractor. If the Employer accepts these proposals, the Intended Completion Date shall be adjusted accordingly and confirmed by both the Employer and the Contractor.
- 27.2. If the Contractor's priced proposals for acceleration are accepted by the Employer, they are incorporated in the Contract Price and treated as a Variation.

28. Delays Ordered by the Project Manager

- 28.1. The Project Manager may instruct the Contractor to delay the start or progress of any activity within the Works.

29. Management Meetings

- 29.1. The Project Manager or on the request of the Contractor may convene a management meeting and the Project Manager may require the Contractor to attend the management meeting. The business of a management meeting shall be to review the plans for remaining work and to deal with matters raised in accordance with the early warning procedure.
- 29.2. The Project Manager shall record the business of management meetings and provide copies of the record to those attending the meeting and to the Employer. The responsibility of the parties for actions to be taken shall be decided by the Project Manager either at the management meeting or after the management meeting and stated in writing to all who attended the meeting.

30. Early Warning

- 30.1. The Contractor shall warn the Project Manager at the earliest opportunity of specific likely future events or circumstances that may adversely affect the quality of the work, increase the Contract Price, or delay the execution of the Works. The Project Manager may require the Contractor to provide an estimate of the expected effect of the future event or circumstance on the Contract Price and Completion Date. The estimate shall be provided by the Contractor as soon as reasonably possible.
- 30.2. The Contractor shall cooperate with the Project Manager in making and considering proposals for how the effect of such an event or circumstance can be avoided or reduced by anyone involved in the work and in carrying out any resulting instruction of the Project Manager.

C. Quality Control

31. Identifying Defects

- 31.1. The Project Manager and PDMC appointed by GSCDL shall check the Contractor's work and notify the Contractor of any Defects that are found. Such checking shall not affect the Contractor's responsibilities. The Project Manager may instruct the Contractor to search for a Defect and to uncover and test any work that the Project Manager considers may have a Defect.
- 31.2. The contractor shall ensure that the raw materials, goods & related services procured/deployed under this contract/project should comply with the technical specifications and other provisions of Contract.

The contractor shall be supply and use and will be held responsible for raw materials, goods & related services under this contract/project shall conform to the standards mentioned in the Sikkim SOR and when no applicable standard is mentioned, the standard shall be equivalent or superior to the official standards whose application is appropriate to the superior quality in reference to as mentioned in description in BoQ.

32. Tests

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

33. Correction of Defects

- 33.1. The Project Manager shall give notice to the Contractor of any Defects before the end of the Defects Liability Period, which begins at Completion, and is defined in the PCC. The Defects Liability Period shall be extended for as long as Defects remain to be corrected.

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- 33.2. Every time notice of a Defect is given, the Contractor shall correct the notified Defect within the length of time specified by the Project Manager's notice.

34. *Uncorrected Defects*

- 34.1. If the Contractor has not corrected a Defect within the time specified in the Project Manager's notice, the Project Manager shall assess the cost of having the Defect corrected, and the Contractor shall pay this amount.

D. Cost Control

35. *Contract Price*

- 35.1. In the case of an admeasurements contract, the Bill of Quantities shall contain priced items for the Works to be performed by the Contractor. The Bill of Quantities is used to calculate the Contract Price. The Contractor will be paid for the quantity of the work accomplished at the rate in the Bill of Quantities for each item.
- 35.2. In the case of a lump sum contract, the Activity Schedule shall contain the priced activities for the Works to be performed by the Contractor. The Activity Schedule is used to monitor and control the performance of activities on which basis the Contractor will be paid. If payment for Materials on Site shall be made separately, the Contractor shall show delivery of Materials to the Site separately on the Activity Schedule.

36. *Changes in the Contract Price*

- 36.1. In the case of an admeasurements contract:
- (a) If the final quantity of the work done differs from the quantity in the Bill of Quantities for the particular item by more than 25 percent, provided the change exceeds 1 percent of the Initial Contract Price, the Project Manager shall adjust the rate to allow for the change.
 - (b) The Project Manager shall not adjust rates from changes in quantities if thereby the Initial Contract Price is exceeded by more than 15 percent, except with the prior approval of the Employer.
 - (c) If requested by the Project Manager, the Contractor shall provide the Project Manager with a detailed cost breakdown of any rate in the Bill of Quantities.
- 36.2. In the case of a lump sum contract, the Activity Schedule shall be amended by the Contractor to accommodate changes of Program or method of working made at the Contractor's own discretion. Prices in the Activity Schedule shall not be altered when the Contractor makes such changes to the Activity Schedule.

37. *Variations*

- 37.1. All Variations shall be included in updated Programs, produced by the Contractor.
- 37.2. The Contractor shall provide the Project Manager with a quotation for carrying out the Variation when requested to do so by the Project Manager. The Project Manager shall

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assess the quotation, which shall be given within seven (7) days of the request or within any longer period stated by the Project Manager and before the Variation is ordered.

- 37.3. If the Contractor's quotation is unreasonable, the Project Manager may order the Variation and make a change to the Contract Price, which shall be based on the Project Manager's own forecast of the effects of the Variation on the Contractor's costs.
- 37.4. If the Project Manager decides that the urgency of varying the work would prevent a quotation being given and considered without delaying the work, no quotation shall be given and the Variation shall be treated as a Compensation Event.
- 37.5. The Contractor shall not be entitled to additional payment for costs that could have been avoided by giving early warning.
- 37.6. In the case of an admeasurements contract, if the work in the variation corresponds with an item description in the Bill of Quantities and if, in the opinion of the Engineer, the quantity of work to be executed is an extra item and the rates in the bill of quantities shall be used for calculate the value of variation. If the cost per unit of quantity changes, or if the nature or timing of the work in the variation does not correspond with item in the BoQ, the procedure explained in the above Para i.e., 36.1 (i), the data rate based on schedule of rate of the year of execution or market rate (when Schedule of Rate is not available) shall be followed for arriving the rate for the new item. .

38. Cash FlowForecasts

- 38.1. When the Program, or, in the case of a lump sum contract, the Activity Schedule, is updated, the Contractor shall provide the Project Manager with an updated cash flow forecast. The cash flow forecast shall include different currencies, as defined in the Contract, converted as necessary using the Contract exchange rates.

39. Payment Certificates

- 39.1. The Contractor shall submit to the Project Manager monthly statements of the estimated value of the work executed less the cumulative amount certified previously.
- 39.2. The Project Manager shall check the Contractor's monthly statement and certify the amount to be paid to the Contractor, subject to statutory deductions and any other deductions coming from Clause 48. The Project Manager shall within 28 days after receiving a statement and supporting documents from the Contractor, issue to the employer, an Interim Payment Certificate.
- 39.3. The value of work executed shall be determined by the Project Manager.
- 39.4. The value of work executed shall comprise:
 - (a) In the case of an admeasurements contract, the value of the quantities of work in the Bill of Quantities that have been completed; or
 - (b) In the case of a lump sum contract, the value of work executed shall comprise the value of completed activities in the Activity Schedule.

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- 39.5. The value of work executed shall include the valuation of Variations and Compensation Events.
- 39.6. The Project Manager may exclude any item certified in a previous certificate or reduce the proportion of any item previously certified in any certificate in the light of later information.

40. Compensation Events

- 40.1. The following shall be Compensation Events:
- (a) The Employer does not give access to a part of the Site by the Site Possession Date pursuant to GCC 20.1.
 - (b) The Employer modifies the Schedule of Other Contractors in a way that affects the work of the Contractor under the Contract.
 - (c) The Project Manager orders a delay or does not issue Drawings, Specifications required for execution of the Works on time.
 - (d) The Project Manager instructs the Contractor to uncover or to carry out additional tests upon work, which is then found to have no Defects.
 - (e) Ground conditions are substantially more adverse than could reasonably have been assumed before issuance of the Letter of Acceptance from the information issued to bidders (including the Site Investigation Reports), from information available publicly and from a visual inspection of the Site.
 - (f) The Project Manager gives an instruction for dealing with an unforeseen condition, caused by the Employer, or additional work required for safety or other reasons.
 - (g) Other contractors, public authorities, utilities, or the Employer does not work within the dates and other constraints stated in the Contract, and they cause delay or extra cost to the Contractor.
 - (h) The advance payment is delayed.
 - (i) The effects on the Contractor of any of the Employer's Risks.
 - (j) The Project Manager unreasonably delays issuing a Certificate of Completion.
- 40.2. If a Compensation Event would cause additional cost or would prevent the work being completed before the Intended Completion Date, the Contract Price shall be increased and/or the Intended Completion Date shall be extended. The Project Manager shall decide whether and by how much the Contract Price shall be increased and whether and by how much the Intended Completion Date shall be extended.
- 40.3. As soon as information demonstrating the effect of each Compensation Event upon the Contractor's forecast cost has been provided by the Contractor, it shall be assessed by the Project Manager, and the Contract Price shall be adjusted accordingly. If the Contractor's forecast is deemed unreasonable, the Project Manager shall adjust the Contract Price based on the Project Manager's own forecast. The Project Manager shall assume that the Contractor shall react competently and promptly to the event.
- 40.4. The Contractor shall not be entitled to compensation to the extent that the Employer's interests are adversely affected by the Contractor's not having given early warning or not having cooperated with the Project Manager.

41. Payments

- 41.1. Payments shall be adjusted for deductions for advance payments & its interests and retention. The Employer shall pay the Contractor the amounts certified by the Project Manager according to each certificate.
- 41.2. If an amount certified is increased in a later certificate or as a result of an award by the Adjudicator or an Arbitrator same shall be paid to contractor.
- 41.3. Unless otherwise stated, all payments and deductions shall be paid or charged in the proportions of currencies comprising the Contract Price.
- 41.4. Items of the Works for which no rate or price has been entered in shall not be paid for by the Employer and shall be deemed covered by other rates and prices in the Contract.

42. Tax

- 42.1. The rates quoted by the Contractor shall be deemed to be inclusive of all the taxes, levies, etc. including GST including their variations as notified by the concerned authority from time to time, and also of all the new taxes and levies that may be imposed that the Contractor will have to pay for the performance of this Contract. The Employer on behalf of the Employer will perform such duties in regard to the deduction of such taxes at source as per applicable law.
- 42.2. The Contractor shall comply with the proper bye-laws and legal orders of the local body or public authority under the jurisdiction of which the work is executed and pay all fees and charges for which he may be liable. Nothing extra shall be payable on this account.
 - (j) The rates quoted by the Contractor shall be deemed to be inclusive of all the prevailing taxes/octroi that the Contractor has to pay for performance of this contract. The Employer shall perform such duties in regard to the deduction of such taxes as per statutory deduction requirements at the source of payment as per applicable rules.
- 42.3.
 - (i) Exemptions: The bidder shall refer such notifications/circulars/orders of the Government of India issued from time to time and shall quote his rates accordingly considering the exemptions available. The Employer will give the necessary certificates to the selected bidders to claim the exemption on specific requests made by the Contractor. Any conditional bids in this regard will not be accepted. The quoted rates should be based on the exemptions available and it will be responsibility of the Contractor to avail the exemptions, as per the contents of the notifications/circulars/orders, the Employers responsibility being limited to the issue of necessary certificates and will not take any responsibility of any kind in this regard.
 - (ii) It may also be noted that if the Government of India announces any exemptions on any statutory levies in future also during the tenure of the

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Contract, all the benefits accruing in view of such further exemptions of any kind on the taxes, shall be passed on to the Employer.

43. Currencies

- 43.1. Where payments are made in currencies other than Indian Rupees (INR), the exchange rates used for calculating the amounts to be paid shall be the exchange rates stated in the Contractor's Bid.

44. Price Adjustment

- 44.1. Prices shall be adjusted for fluctuations in the cost of inputs only if provided for in the PCC. If so provided, the amounts certified in each payment certificate, before deducting for Advance Payment, shall be adjusted by applying the respective price adjustment factor to the payment amounts due in each currency.

The following conditions shall apply:

(a) No price increase will be allowed beyond the original completion date unless covered by an extension of time awarded by the Employer under the terms of the Contract. No price increase will be allowed for periods of delay for which the Contractor is responsible. The Employer will, however, be entitled to any price decrease occurring during such periods of delay.

(b) Deleted.

(c) No price adjustment shall be payable on the portion of the Contract price paid to the Contractor as an advance payment.

Base, Current and Provisional Indices: the base cost and indices or prices shall be those prevailing on the day 28 days prior to the latest date for submission of Bid. Current indices or prices shall be those prevailing on the quarter for which a particular interim Payment Certificate is related. If at any time the current indices are not available, no provisional escalation will be payable on the basis of indices of the previous quarter in absence of non-publication of indices for concerned quarter by the RBI. Escalation amount will be payable to the Contractor when the current indices become available.

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 including the amount at base rates and prices of the schedule works carried out but excluding provisional sums and the value of materials on the 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.

Adjusted Amount: The adjusted amount of each payment certificate shall be determined by applying the price adjustment factor to the adjustable amount, and shall become payable to the contractor subject to any deductions there from for retention money, liquidated damages and any other monies due to the Employer from the Contractor including the recovery of advance mobilization, loan if any.

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If the Contractor fails to complete the Works within the Time for Completion, adjustments of prices thereafter shall be made using either each index or price applicable on the date 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 the relevant Sub-Clause the above provision shall apply to the extended time for completion.

- 44.2. If the value of the index is changed after it has been used in a calculation, the calculation shall be corrected and an adjustment made in the next payment certificate. The index value shall be deemed to take account of all changes in cost due to fluctuations in costs.

45. Retention

- 45.1. The Employer shall retain from each payment due to the Contractor the proportion stated in the PCC until Completion of the whole of the Works.
- 45.2. Upon the issue of a Certificate of Completion of the Works by the Project Manager, in accordance with GCC 52.1, half the total amount retained shall be repaid to the Contractor and half when the Defects Liability Period has passed and the Project Manager has certified that all Defects notified by the Project Manager to the Contractor before the end of this period have been corrected. The Contractor may substitute retention money with an unconditional bank guarantee.

46. Liquidated Damages

- 46.1. The Contractor shall pay liquidated damages to the Employer as compensation for delay at the rate per day stated in the PCC for each day that the Completion Date is later than the Intended Completion Date. The total amount of liquidated damages shall not exceed the amount defined in the PCC. The Employer may deduct liquidated damages from payments due to the Contractor. Payment of liquidated damages shall not affect the Contractor's liabilities.
- 46.2. If the Intended Completion Date is extended after liquidated damages have been paid, the Project Manager shall correct any overpayment of liquidated damages by the Contractor by adjusting the next payment certificate. The Contractor shall be paid interest on the overpayment, calculated from the date of payment to the date of repayment, at the rates specified in GCC 40.1.

47. Bonus

- 47.1. The Contractor shall be paid a Bonus calculated at the rate per calendar day stated in the PCC for each day (less any days for which the Contractor is paid for acceleration) that the Completion is earlier than the Intended Completion Date. The Project Manager shall certify that the Works are complete, although they may not be due to be complete.

48. Advance Payment

- 48.1. The Employer shall make advance payment of not more 15 percent of the estimated cost put to tender may be given with the approval of the competent authority, if requested by the contractor in writing within one month of the order to commence the work as stated in the PCC by the date stated in the PCC, against provision by the Contractor of an unconditional bank guarantee bond in a form and by a bank acceptable to the Employer in amounts and currencies equal to 110% to the advance payment amount. The bank guarantee shall remain effective until the advance payment has been repaid, but the amount of the bank guarantee shall be progressively reduced by the amounts repaid by the Contractor. Interest on mobilization advance shall be levied as per the Government Notification and as amended prior to conclusion of this contract. The amount of mobilization advance, if paid to the contractor, shall be recovered from each monthly bill / running account bill payable to the contractor for the work done so that the entire amount is recovered before completion of 60% of the Contract value. In case of any difficulty in recovering the advance, it shall be recovered from the bank guarantee given by the Contractor. The Contractor may, at his option, can repay the advance earlier by increasing the percentage rate of deductions from invoice raised.
- 48.2. The Contractor is to use the advance payment only to pay for Equipment, Plant, Materials, and mobilization expenses required specifically for execution of the Contract. The Contractor shall demonstrate that advance payment has been used in this way by supplying copies of invoices or other documents to the Project Manager.
- 48.3. The advance payment shall be recovered at a rate of minimum of 10 % (ten percent) of the amount of advance payment from the first and every subsequent bills until the full advance paid has been recovered. However the Project Manager has the liberty to recover more than 10 % amount if he feels the pattern of submission of bills of the contractor warrants deduction of more amount for recovery of advance amount. If the advance amount is not recovered fully before the intended time of completion, penalty interest @ 8% will be recovered for the outstanding amount.

49. Securities

- 49.1. The Performance Security shall be provided to the Employer no later than the date specified in the Letter of Acceptance and shall be issued in an amount specified in the PCC, by a bank acceptable to the Employer, and denominated in the types and proportions of the currencies in which the Contract Price is payable. The Performance Security shall be valid until a date 28 days from the date of issue of the Certificate of Completion in the case of a bank guarantee.

50. Day works

- 50.1. If applicable, the Day works rates in the Contractor's Bid shall be used for small additional amounts of work only when the Project Manager has given written instructions in advance for additional work to be paid for in that way.

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- 50.2. All work to be paid for as Day works shall be recorded by the Contractor on forms approved by the Project Manager. Each completed form shall be verified and signed by the Project Manager within two days of the work being done.
- 50.3. The Contractor shall be paid for Day works subject to obtaining signed Day works forms.

51. Cost of Repairs

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

E. Finishing the Contract

52. Completion

- 52.1. The Contractor shall request the Project Manager to issue a certificate of Completion of the Works, and the Project Manager shall do so upon deciding that the work is completed.

53. Taking Over

- 53.1. The Employer shall take over the Site and the Works within seven days of the Project Manager's issuing a certificate of Completion.

54. Final Account

- 54.1. The Contractor shall supply the Project Manager with a detailed account of the total amount that the Contractor considers payable under the Contract before the end of the Defects Liability Period. The Project Manager shall issue a Defects Liability Certificate and certify any final payment that is due to the Contractor within 56 days of receiving the Contractor's account if it is correct and complete. If it is not, the Project Manager shall issue within 56 days a schedule that states the scope of the corrections or additions that are necessary. If the Final Account is still unsatisfactory after it has been resubmitted, the Project Manager shall decide on the amount payable to the Contractor and issue a payment certificate.

55. Operating and Maintenance Manuals

- 55.1. If "as built" Drawings and/or operating and maintenance manuals are required, the Contractor shall supply them within 14 days after completion of the component/ milestone.

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- 55.2. If the Contractor does not supply the Drawings and/or manuals by the dates stated in GCC 55.1, or they do not receive the Project Manager's approval, the Project Manager shall withhold 5% of the next interim payment due to the Contractor.

56. Termination

- 56.1. The Employer or the Contractor may terminate the Contract if the other party causes a fundamental breach of the Contract.
- 56.2. Fundamental breaches of Contract shall include, but shall not be limited to, the following:
- (a) the Contractor stops work for 28 days when no stoppage of work is shown on the current Program and the stoppage has not been authorized by the Project Manager;
 - (b) the Project Manager instructs the Contractor to delay the progress of the Works, and the instruction is not withdrawn within 28 days;
 - (c) the Employer or the Contractor is made bankrupt or goes into liquidation other than for a reconstruction or amalgamation;
 - (d) a payment certified by the Project Manager is not paid by the Employer to the Contractor within 84 days of the date of the Project Manager's certificate; atleast 15 days before the expiry of 84 days' time period, the contractor should address a letter informing the same and requesting for early release of payment.
 - (e) the Project Manager gives Notice that failure to correct a particular Defect is a fundamental breach of Contract and the Contractor fails to correct it within a reasonable period of time determined by the Project Manager;
 - (f) the Contractor does not maintain a Security, which is required; and
 - (g) the Contractor has delayed the completion of the Works by the number of days for which the maximum amount of liquidated damages can be paid, as defined in the PCC.
 - (h) if the Contractor, in the judgment of the Employer has engaged in corrupt or fraudulent practices in competing for or in executing the Contract, pursuant to GCC 57.1.
- 56.3. When either party to the Contract gives notice of a breach of Contract to the Project Manager for a cause other than those listed under GCC 56.2 above, the Project Manager shall decide whether the breach is fundamental or not.
- 56.4. Notwithstanding the above, the Employer may terminate the Contract for convenience.
- 56.5. If the Contract is terminated, the Contractor shall stop work immediately, make the Site safe and secure, and leave the Site as soon as reasonably possible.

57. Fraud and Corruption

- 57.1. GSCDL requires Contractors, Subcontractors, manufacturers & Suppliers, observe the highest standard of ethics during the procurement and execution of contract(s). In pursuit of this policy, the GSCDL:
- (a) defines, for the purposes of this provision, the terms set forth below as follows:

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- (i) “corrupt practice” means the offering, giving, receiving, or soliciting, directly or indirectly, anything of value to influence improperly the actions of another party;
 - (ii) “fraudulent practice” means any act or omission, including a misrepresentation, that knowingly or recklessly misleads, or attempts to mislead, a party to obtain a financial or other benefit or to avoid an obligation;
 - (iii) “coercive practice” means impairing or harming, or threatening to impair or harm, directly or indirectly, any party or the property of the party to influence improperly the actions of a party;
 - (iv) “collusive practice” means an arrangement between two or more parties designed to achieve an improper purpose, including influencing improperly the actions of another party.
- (b) will cancel the allocated contract if GSCDL determines at any time that representatives of the Contractor or sub-contractors if permitted under this contract are found to be engaged in corrupt, fraudulent, collusive or coercive practices during the procurement or the execution of that contract, without the Contractor having taken timely and appropriate action satisfactory to the GSCDL and or competent authority to remedy the situation the said contract would be terminated; and
- (c) will sanction a firm or individual, including declaring them ineligible, either indefinitely or for a stated period of time, to be awarded a GSCDL financed contract if it at any time determines that they have, directly or through an agent, engaged in corrupt, fraudulent, collusive or coercive practices in competing for, or in executing, a GSCDL-financed contract.

58. Payment upon Termination

58.1. If the Contract is terminated because of a fundamental breach of Contract by the Contractor, the Project Manager shall issue a certificate for the value of the work done and Materials ordered less advance payments received up to the date of the issue of the certificate and less the percentage to apply to the value of the work not completed, as indicated in the PCC. Additional Liquidated Damages shall not apply. If the total amount due to the Employer exceeds any payment due to the Contractor, the difference shall be a debt payable to the Employer.

The Contractor shall comply with all applicable national and local environmental laws and regulations.

The Contractor shall (a) establish an operational system for managing environmental impacts, (b) carry out all the monitoring and mitigating measures as set forth in Project’s Environmental Management Plan (EMP), attached here to as Appendix 1 (the actual costs for the implementation of such measures shall be reimbursed by the Employer from provision sums). The contractor shall submit to the Employer quarterly report on the carrying out of such measures.

The Contractor Shall (a) comply with all applicable labor laws, and (b) provide equal pay for men and women for work of equal value or type.

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The Contractor shall not employ child labor, as defined in national legislation for construction and maintenance activities.

The Contractor shall give priority to the employment of local people, who meet the job and efficiency requirements, for the Contract works.

The Contractor shall not employ for the contract works (a) any person that has relationship with any of the officials of the Contractor (i.e., spouses or first blood relations), and (b) any person who retired, within the last two years, as a gazette officer from any department of the government of Sikkim.

- 58.2. If the Contract is terminated for the Employer's convenience or because of a fundamental breach of Contract by the Employer, the Project Manager shall issue a certificate for the value of the work done, Materials ordered, the reasonable cost of removal of Equipment, repatriation of the Contractor's personnel employed solely on the Works, and the Contractor's costs of protecting and securing the Works, and less advance payments received up to the date of the certificate.

59. Property

- 59.1. All Materials on the Site, Plant, Equipment, Temporary Works, and Works shall be deemed to be the property of the Employer if the Contract is terminated because of the Contractor's default.

60. Release from Performance

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

61. Suspension of Loan or Credit

- 61.1. deleted

62. Eligibility

The Contractor shall have the Indian nationality. The Contractor shall be deemed to have the nationality of a country if the Contractor is a citizen or is constituted, or incorporated, and operates in conformity with the provisions of the laws of that country. This criterion shall also apply to the determination of the nationality of proposed subcontractors or suppliers for any part of the Contract including related services.

- 62.1. The materials, equipment and services to be supplied under the Contract shall have their origin in India and all expenditures under the Contract will be limited to such materials, equipment, and services. At the Employer's request, the Contractor may be required to provide evidence of the origin of materials, equipment and services.

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62.2. For purposes of GCC 62.2, “origin” means the place where the materials and equipment are mined, grown, produced or manufactured, and from which the services are provided. Materials and equipment are produced when, through manufacturing, processing, or substantial or major assembling of components, a commercially recognized product results that differs substantially in its basic characteristics or in purpose or utility from its components.

63. Indemnities

63.1. Each party shall be liable for and indemnify the other Party against losses, expenses and claims for loss or damage to physical property, personal injury, and death caused by his own acts or omissions, subject to the exception defined in Clause 63.3.

63.2. Notwithstanding Clause 63.1 above, the Contractor shall be solely responsible for and shall indemnify and hold harmless the Employer from and against all claims, liabilities and costs of action in respect of injury to or both of any person in the employment of the Contractor or any of his Subcontractors subject to exceptions defined in clause 63.3.

63.3. The “exceptions” referred to in Clause 63.2 are:

a. the permanent use or occupation of land by the Works, or any part thereof,

b. the right of the Employer to execute the Works, or any part thereof, on, over, under, in or through any land

c. damage to property which is the unavoidable result of the execution and completion of the Works, or the remedying of any defects therein, in accordance with the Contract, and

d. death or injury to persons or loss of or damage to property resulting from any act or neglect of the Employer, or his agents, servants or other contractors, not being employed by the Contractor, or in respect of any claims, proceedings, damages, costs, charges and expenses in respect thereof or in relation thereto or, whether the injury or damage was contributed to by the Contractor, his servants or agents, such part of the said injury or damage as may be just and equitable having regard to the extent of the responsibility of the Employer, his servants or agents or other contractors for the injury or damage.

64. Indemnities

Deleted

65. Royalties

65.1. Except otherwise stated, the Contractor shall pay all tonnage and other royalty charges and other payments or compensation, if any for getting stone, sand, gravel, clay or other materials required for the works.

66. Third Party Inspection and Testing

- 66.1. The representative of the concerned independent consultant appointed by the Employer will undertake independent third party inspections and testing for supply and installation pipes and valves used for water supply and sewerage, pumps and motors and all works and any civil structure or material or work as may be applicable and as desired by the Project Manager. The Contractor shall be wholly responsible to make his own arrangements with the approved third party inspection agencies for carrying out the required tests. The Contractor shall be responsible to obtain permission for and provide all facilities to such agency for carrying out such inspections or testing as may be required. The Third Party Inspection charges of the agency only will be paid by the employer and all the other costs for such independent inspection and testing shall be borne by the contractor.
- 66.2. A mutually agreed quality assurance plan with minimum requirements as per Indian Standards will be developed which provides for inspection and certification by the third party inspection agency at specified times.
- 66.3. No material shall be delivered to the site without formal inspection or testing unless otherwise waived in writing by the Project Manager with a certificate issued by the contractor, which is endorsed by the Engineer that the item conforms to the requirement of contract in all respects.
- 66.4. The Employer or his authorized representative may make inspections at any of the manufacturing or shipping points at any time in addition to the schedule provided in this specification at the cost of Employer. However, during such inspection, if it is found that any of the items are not being supplied, manufactured or transported in accordance with the specifications, the contractor shall bear all expenses including fees incurred by the employer in respect of such inspection.
- 66.5. The contractor shall perform or make arrangements for all tests when requested by the Employer.
- 66.6. The Contractor shall agree with the Project Manager on the time and place for the inspection of any materials or plant. The Project Manager shall give the contractor not less than 24 hours' notice of his intention to carry out inspection or to attend the tests. If the Project Manager or his duly authorized representative does not attend on the date agreed, the Contractor may, unless otherwise instructed by the Project Manager, proceed with the test reports.
- 66.7. If at the time and place agreed in accordance with as mentioned in the clause 66.4 and 66.6, the materials or Plant if, as a result of the inspection or testing referred to in this Clause, the Project Manger determines that the materials or plant are defective or otherwise not in accordance with the contract, he may reject the materials or plant and shall notify the contractor there of immediately. The notice shall state the Project Manager's observations with reasons. The Contractor shall then promptly make good the defect or replace the same. If the Project Manager so requests, the tests of such material or plant shall be made or repeated under the same terms and conditions. All costs incurred by the Project Manager or the Third Party inspection agency for the inspection of the tests shall be determined by the Project Manager and shall be recoverable from the

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contractor and may be deducted from any money's due that the Contractor and the Project Manager shall notify the Contractor accordingly.

66.8. Any inspection carried out by the Project Manager shall not relieve the contractor of his obligations under the contract.

67. Licenses for Explosives

67.1. The Contractor should take necessary licenses under the current explosive rules to enable him to manufacture and process the quantity of gunpowder / explosive and perform the blasting as necessary according to prevailing rules.

68. Indemnities

Deleted

69. Incomplete or unattended defective works or delays

The Employer has the right to get the uncompleted works done by other competent contractors at the risk and cost of the contractor in the following circumstances:

- a) If the contract is terminated for the reasons attributable to the contractor
- b) If the Contractor has delayed the work as per the schedule with no justifiable reasons.
- c) If the Contractor fails to correct any defects in the work within the period stated in the defects notice sent by the Project Manager to the Contractor.
- d) If the Contractor does not meet any of its obligations within the time frame of the contract specified in section 7 GCC or section 8 PCC

70. Contractor's General Responsibilities

70.1. The Contractor shall, with due care and diligence, execute and complete the Works and remedy any defects therein accordance with the provisions of the Contract. The Contractor shall provide all superintendence, labour, materials, Plant, Contractor's Equipment and all other things, whether of a temporary or permanent nature, execution, completion and remedying of any defects, so far as the necessity for providing the same is specified in or is reasonably to be inferred from the Contract.

70.2. The Contractor shall promptly notify the Employer, of any error, omission, fault or other defect in the design of or Specification for the Works which he discovers when reviewing the Contract or executing the Works.

70.3. The Contractor shall take full responsibility for the adequacy, stability and safety of all Site operations and methods of construction. Provided that the Contractor shall not be responsible (except as stated hereunder or as may be otherwise agreed) for the design or specification of Permanent Works, not prepared by the Contractor. Where the Contract expressly provides that part of the Permanent Works shall be designed by the Contractor, he shall be fully responsible for that part of such Works, notwithstanding any approval by the Employer.

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70.4. The Contractor shall provide all necessary superintendence during the execution of the Works and as long as thereafter as the Project Manager may consider necessary for the proper fulfilling of the Contractor's obligations under the Contract. The Contractor, or a competent and authorized representative approved of by the Project Manager, which approval may at any time be withdrawn, shall give his whole time to the superintendence of the Works. Such authorized representative shall receive, on behalf of the Contractor, instructions from the Engineer. If the approval of the representative is withdrawn by the Project Manager, the Contractor shall, as soon as is practicable, having regard to the requirement of replacing him as hereinafter mentioned, after receiving notice of such withdrawal, remove the representative from the Works and shall not thereafter employ him again on the Works in any capacity and shall replace him by another representative approved by the Project Manager.

70.5. The Contractor shall be responsible for:

- (a) the accurate setting-out of the Works in relation to original points, lines and levels of reference given by the Engineer in writing,
- (b) the correctness, subject as above mentioned, of the position, levels, dimensions and alignment of all parts of the Works, and
- (c) The provision of all necessary instruments, appliances and labour in connection with the foregoing responsibilities.

If, any time during the execution of the Works, any error appears in the position, levels, dimensions or alignment of any part of the Works, the Contractor, on being required so to do by the Project Manager, shall, at his own cost, rectify such error to the satisfaction of the Project Manager, unless such error is based on incorrect data supplied in writing by the Project Manager, in which case the Project Manager shall determine an addition to the Contract Price as per the relevant provisions of the contract and shall notify the Contractor accordingly. The checking of any setting-out or of any line by the Project Manager shall not in any way relieve the Contractor of his responsibility for the accuracy thereof and the Contractor shall carefully protect and preserve all bench-marks, sigh-rails, pegs and other things used in setting-out the Works.

71. Water for works and workforce

71.1. The contractor at his own expenses should provide water from municipal mains or other sources for the use of work and workmen.

72. Project Manager and Project Manager's representative

72.1. The Project Manager is the representative of the Employer and the contractor is bound to take all his instructions as that of the employer. The Project Manager shall represent the employer in all dealings with the Contractor concerning the work, including administering contract, certifying payments due to the contractor, issuing and valuing variations, awarding extension of times and valuing compensation events as per the powers delegated to him by the employer and after taking necessary approvals.

- 72.2. The Project Manager's representative who would be appointed to assist the Project Manager would be notified to the Contractor. The Employer / Project Manager may employ any other additional representative for managing this contract.
- 72.3. The Project Manager may from time to time delegate any of his duties and authorities, to his representative, and he may at any time revoke such delegation. Any such delegation or revocation shall be in writing and shall not take effect until copy thereof has been delivered to the Employer and the Contractor.
- 72.4. The Project Manger's representative may appoint any number of persons to assist the Project Manager's representative in carrying out his duties. He shall notify to the Contractor the names, duties and scope of authority of such persons.

73. Alterations, Additions and Omissions

- 73.1. The Project Manager shall make any variation of the form, quality or quantity of the Works or any part thereof that may, in his opinion, be necessary and for that purpose, or if for any reason it shall, in his opinion appropriate he shall have the authority to instruct the Contractor to do and the Contractor shall do any of the following:
- (a) increase or decrease the quantity of any work included in the Contract,
 - (b) omit any such work
 - (c) change the character or quality or kind of any such work,
 - (d) change the levels, lines, position and dimensions of any part of the Works,
 - (e) execute additional work of any kind necessary for the completion of the Works, or
 - (f) change any specified sequence or timing of construction of any part of the Works.
- No such variation shall in any way vitiate or invalidate the Contract, but the effect, if any, of all such variations shall be valued in accordance with relevant provisions of the Contract. Provided that where the issue of an instruction to vary the Works is necessitated by some default of or breach of contract by the Contractor or for which he is responsible, any additional cost attributable to such default shall be borne by the Contractor.

74. Deleted

75. Site Order Book

- 75.1. A site order book is to be maintained at site by the contractor for issue of necessary instructions during the site visits. It is binding on the contractor to enforce such instructions and if the compliance of such instructions would have financial implications, the contractor need to inform the Project Manager on the financial implications on executing the instruction, obtain his permission, and sanction before executing such works. No additional payment would be made on the basis of the instructions of the site order alone. The site in charge of the Employer and the Contractor should sign both while issuing the order and after compliance. The site order book needs to be serially numbered. The site order should be maintained by the contractor throughout the work and submitted to the Project Manager before the payment of the final bill.

76. Measurement Book:

76.1. All measurements should be recorded directly in the Measurement Book as per the instructions printed in the Measurement Book.

77. Sikkim State Building & Other Construction Workers Welfare Fund:

77.1. The contractor for this work shall be bound to remit an amount equal to 1 % (one percent) of the value of the work to be done on account of this contract, excluding cost of departmental materials, towards the employer's (Contractor) contribution to Sikkim State Building & Other Construction Workers Welfare Fund as provided in Sikkim Construction Workers Fund. The amount shall be recovered proportionately from the part bills and the final bill for the work and the contractor shall abide by such recoveries.

78. Safety, Security and Protection of the Environment

78.1. Accidents – Hoarding – Lighting – Observations – Watchmen:

The contractor shall be responsible for the safety of the labour employed by him and he shall be liable for payment of necessary compensation in the case of accidents as per workers compensation act.

- a) When excavations have been made or obstacles have been put in public through-fares or in places where there is likelihood of accidents, the contractor shall comply with any requirement of law on the subject and shall provide suitable Hoarding- Lighting, watchmen when and where necessary or required by the Project Manager or by any duly constituted authority, for protection of works and safety and convenience of the public or others. In case of excavations on roads, a traffic diversion plan should be made and got approved by the concerned authorities.
- b) It shall be the contractor's sole responsibility to protect the public and its employees against the accident from any cause and he shall indemnify the Government against any claims for damages for injury to person or property, resulting from any such accidents and he shall, where the provisions of the Workmen's Compensation Act apply, take steps to properly insure against any claims thereafter.
- c) On the occurrence of an accident which results in the death of any of the workmen employed by the contractor or which is so serious as to be likely to result in the death of any such workmen, the contractor shall within 24 hours of the happening of such accidents, intimate the employer in writing, the fact of such accident. The contractor shall indemnify Government against all loss or damage sustained by the Government resulting directly or indirectly from his failure to give intimation in the manner aforesaid including the penalties or fines if any payable by the Government as a consequence of Government's failure to give notice under the Workmen's Compensation Act or otherwise confirm to said Act in regard to such accident.
- d) In the event of an accident in respect of which compensation may become payable under the workmen's Compensation Act VIII of 1923 whether by the Contractor or by the Government as principal it shall be lawful for the Project Manger to retain out of moneys due and payable to the

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contractor such sum or sums of money as may, the opinion of the Project Manager shall be final in regard or all matters arising under this clause.

78.2. Noise, Disturbance and Pollution:

Works shall be carried out without unreasonable noise and disturbance. The Contractor shall indemnify the Employer from and against any liability for damages on account of noise or other disturbances created while executing the Works and from against all claims, demands, proceedings, damages, costs, charges and expenses whatsoever in regard or in relation to such liability. Necessary permissions as may be required from Pollution Control Board or any other regulatory authority shall have to be obtained by the Contractor for erecting and operating any plant or machinery and for other operations required for the execution of the Works in the Contract.

78.3 Site Sanitation:

The contractor should provide and erect prior to commencement of the work sufficient latrines for the use of workmen, both males and females and should keep the same disinfected and clean all times during the progress of the work and remove the same and restore to original ground on completion of the works.

78.4 HIV/AIDS awareness and prevention program:

It is obligatory as a part of the Contractor to carryout HIV / AIDS awareness and prevention program, and dissemination of information on worksites on risks of sexually transmitted diseases and HIV/AIDS as a part of health and safety measures for those employed under the Contract.

78.5 The Contractor shall comply with all applicable environmental laws and regulations and the Contractor shall

(a) establish an operational system for managing environmental impacts,

(b) carry out all of the monitoring and mitigation measures set forth in the Initial Environmental Assessment (IEE) or Environmental Impact Assessment (EIA) and Environment Management Plan (EMP) attached hereto as Appendix 1 (c) allocate the budget required to ensure that such measures are carried out, and the actual costs for the implementation of such measures shall be reimbursed by the Employer to the Contractor from Provisional Sum. The Contractor shall submit to the Employer quarterly reports of the carrying out of such measures.

79. Labour

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

79.2 It is mandatory to the contractor to register all the labours he is engaging at site with the concerned authorities.

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

80. Compliance with Labour Regulations

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

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

80.3. Salient features of some major labor laws applicable to establishments engaged in building and other construction work:

- a) Workmen Compensation Act 1923: The Act provides for compensation in case of injury by accident arising out of and during the course of employment.
- b) Payment of Gratuity Act 1972: Gratuity is payable to an employee under the Act on satisfaction of certain conditions on separation if an employee has completed 5 years' service or more or on death the rate of 15 days wages for every completed year of service. The Act is applicable to all establishments employing 10 or more employees.
- c) Employees P.F and Miscellaneous Provision Act 1952: The Act Provides for monthly contributions by the employer plus workers @ 10% or 8.33%. The benefits payable under the Act are:
 - Pension or family pension on retirement or death, as the case maybe
 - Deposit linked insurance on the death in harness of the worker.
 - Payment of P.F accumulation on retirement/death etc.
- d) Maternity Benefit Act 1951: The Act provides for leave and some other benefits to women employees in case of confinement or miscarriage etc.
- e) Contract labour (Regulation and Abolition) Act 1970: The Act provides for certain welfare measures to be provided by the Contractor to contract labour and in case the Contractor

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fails to provide, the same are required to be provided, by the Principal Employer by Law. the Principal Employer is required to take Certificate of Registration and the Contractor is required to take license from the designated officer. The Act is applicable to the establishments or Contractor of Principal Employer if they employ 20 or more contract labour.

- f) Minimum Wages Act 1948: The Employer is supposed to pay not less than the Minimum Wages fixed by appropriate Government as per provisions of the Act if the employment is a scheduled employment as per the act.
- g) Payment of Wages Act 1936: It lays down as to by what date the wages are to be paid, when it will be paid and what deductions can be made from the wages of the workers.
- h) Equal Remuneration Act 1979: The Act provides for payment of equal wages for work of equal nature to male and Female workers and for not making discrimination against Female Employees in the matters of transfers, training and promotions etc.
- i) Payment of Bonus Act 1965: The Act is applicable to all establishments employing 20 or more employees. The Act provides for payments of annual bonus subject to a minimum of 8.33% of wages and maximum of 20% of wages to employees drawing Rs.3500/ per month or less. The bonus to be paid to employees getting Rs.2500/- per month or above upto Rs.3500/- per month shall be worked out by taking wages as Rs.2500/- per month only. The Act does not apply to certain establishments. The newly set-up establishments are exempted for five years in certain circumstances. Some of the State Governments have reduced the employment size from 20 to 10 for the purpose of applicability of this Act.
- j) Industrial Disputes Act 1947: The Act lays down the machinery and procedure for resolution of Industrial disputes, in what situations a strike or lock – out becomes illegal and what are the requirements for laying off or retrenching the employees or closing down the establishment.
- k) Industrial Employment (Standing Orders) Act 1946: It is applicable to all establishments employing 100 or more workmen (employment size reduced by some of the States and Central Government to 50) The Act provided for laying down rules governing the conditions of employment by the Employer on matters provided in the Act and get the same certified by the designated Authority.
- l) Trade Unions Act 1926: The Act lays down the procedure for registration of trade unions of workmen and employers. The Trade Unions registered under the Act have been given certain immunities from civil and criminal liabilities.
- m) Child Labour (Prohibition and Regulation) Act 1986: The Act prohibits employment of children below 14 years of age in certain occupations and processes and provides for regulation of employment of children in all other occupations and processes. Employment of Child Labour is prohibited in Building and Construction Industry.
- n) Inter-State Migrant Workmen's (Regulation of Employment and Conditions of Service) Act 1979: The Act is applicable to an establishment which employs 5 or more inter-state migrant workmen through an intermediary (who has recruited workmen in one state for employment in the establishment situated in another state). The Inter-State migrant workmen, in an establishment to which this Act becomes applicable, are required to be

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provided certain facilities such as housing, medical aid, traveling expenses from home upto establishment and back, etc.

- o) The Building and Other Construction Workers (Regulation of Employment and Conditions of Service) Act 1996 and the Cess Act of 1996: All the Establishments who carry on any building or other construction work and employs 10 or more workers are covered under this Act. All such establishments are required to pay cess at the rate not exceeding 2% of the cost of construction as may be modified by the Government. The Employer of the establishment is required to provide safety measures at the Building or construction work and other welfare measures, such as Canteens, First Aid facilities, Ambulance, housing accommodations for workers near the work place etc. The employer to whom the Act applies has to obtain a registration certificate from the Registering Officer appointed by the Government.
- p) Factories Act 1948: The Act lays down the procedure for approval at plans before setting up a factory, health and safety provisions, welfare provisions, working hours, annual earned leave and rendering information regarding accidents or dangerous occurrences to designated authorities. It is applicable to premises employing 10 persons or more with aide of power or 20 or more persons without the aid of power engaged in manufacturing process.

80.4. Notwithstanding what is given in the above the acts as amended latest shall apply from time to time

81. Fair Wage Clause:

81.1. The following should be followed in respect of payment of wages to the labour.

- a) The contractor shall pay not less than fair wages to labourers engaged by him on the work. " Fair Wages" means wage whether for time or piece work notified at the time of inviting Bids for the work and where such wages have not been so notified the wage prescribed by the Central PWD for the District in which the work is done".
- b) The contractors shall not withstanding the provisions of any contract to the contrary cause to be paid a fair wage to labourers indirectly engaged on the work including any labour engaged by his subcontractor in connection with the said work as if he labourers had been immediately employed by him.
- c) In respect of all labour directly or indirectly employed in the works for the performance of the Contractor's part of this agreement, the contractor shall comply with or cause to be complied with (the Central P W D Contractor's labour) regulations made by Government in regard to payment of wages, wage period deduction from wages, recovery of wages not paid and deductions unauthorized made, maintenance of wages register, other terms of employment, inspection and submission of periodical returns and all wages cards, publication of scale of wages and returns and all other matters of a like nature.
- d) The Deputy Programme Director or Subdivision Officer concerned shall have the right to deduct from the moneys due to the contractor and any sum required or estimated to be required for making good the loss suffered by a worker or workers by reasons of non-fulfilment of the conditions of the contract for the benefit of works, non-payment of wages or deductions

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made from his or their wages which are not justified by their terms of contract or non-observance of the regulations.

- e) Vis – a Vis the Central Government the Contractor shall be primary liable for all payment to be made under the observance of the regulations aforesaid without prejudice to his right to claim from this subcontractors.
- f) The regulation aforesaid shall be deemed to be a part of this contract and breach there shall, be a breach of this contract.

82. Recovery of compensation paid to workmen

In every case in which by virtue of the provisions sub section(1) of section 12, of the workmen's compensation act 1923, Employer is obliged to pay compensation to a workman employed by the contractor, in execution of the works Employer will recover from the contractor, the amount of compensation so paid ; and without prejudice to the right of the Employer under sub section2 of section 12 , of the said act Employer shall be at liberty to recover such amount or any part thereof by deducting it from the security deposit or any sum due to the Employer to the contract whether under this contract or otherwise. Employer shall not be bound to contest any claim made against it under sub section (1) Section 12 of the said act except on the written request of the contractor and upon his giving to Employer full security for all costs for which Employer become liable in consequence of contesting such claim.

83. Ensuring Sikkim Labour Protection Act 2005:

In every case in which by virtue of the provisions of Sikkim Labour Protection Act Employer shall be at liberty or to recover such amount or any part thereof by deducting it from the Security Deposit or any sum due by Employer to the contractor under this contract or otherwise.

1. The contractor must employ local people whose nationality is not in doubt for execution of works in Sikkim.
2. The labourers employed by the contractor should be of Indian origin only.
3. The Contractor shall obtain a valid certificate of Registration under Sikkim Labour Protection Act 2005 (20 to 2005) and the rules made there under and contractor should abide by all provisions of the act and Rules aforesaid as may be required from time to time regarding wages and other working conditions.
4. No labour below the age of 14 years shall be employed on the work and the contractor shall pay not less than fair wages to labourer engaged by him on the work.
5. The contractor shall comply with the provisions of the payment of wages act 1936 Minimum Wages Act 1948 Employees Labour (Regulation and Abolition) Act 1970 or the modifications thereof or any other laws relating thereto and the rules made there under from time to time by the state Government.

Section 8 - PARTICULAR CONDITIONS OF CONTRACT

The following Particular Conditions of Contract shall supplement the GCC. Whenever there is a conflict, the provisions herein shall prevail over those in the GCC.

A. General	
GCC 1.1 (q)	The Employer is CEO, GSCDL, Sokaythang-737102, Gangtok.
GCC 1.1 (u)	The Intended Completion Date for the whole of the Works shall be 36 months.
GCCs 1.1 (aa) & 4.1	The Project Manager is General Manager, GSCDL, Sokaythang.
GCC 1.1 (cc)	The Sites are located at TATHANGCHEN at Gangtok in Sikkim, India
GCC 1.1 (ff)	The Start Date shall be 7 days from the date of signing the Agreement.
GCC 1.1 (jj)	The Works consist of CONSTRCUTION OF CULTURAL AND CONVENTION CENTRE AT GANGTOK, SIKKIM INCLUDING DEFECT LIABILITY PERIOD OF ONE YEAR
GCC 2.2	Sectional Completions are: Not allowed
GCC 2.3(i)	<p>Any other written agreement reached between the Employer and contractor further to the award of contract shall be in line with the original bidding document only, there will be no contradiction with respect to the clauses, terms and conditions of the original conditions of the contract. The Environment Plan attached hereto as Appendix I shall also form part of the agreement</p> <p>The following documents also form part of the Contract: Environmental Management Plan, attached hereto as Appendix 1.</p>
GCC 3.1	<p>The language of the contract is English.</p> <p>The law that applies to the Contract is the law of Union of India and State of Sikkim. Where there is a conflict between the two, the laws of The Union of</p>

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	India shall prevail.
GCC 8.1	Schedule of other contractors: Nil.
GCC 13.1.1 (b)	Insurance for an additional sum of 15 per cent of replacement cost, to cover any additional costs of and incidental to the rectification of loss or damage including professional fees and the cost of demolishing and removing any part of the Works and of removing debris of whatsoever nature “it being understood that such insurance shall provide for compensation to be payable to rectify the loss or damage incurred”
GCC 13.1.5	Third Party Insurance: Insurance shall be for at least 1 % (one percent of the contract amount) subject to a minimum of Rs.20,00,000/- (Rs. 2 million) per occurrence with number of occurrences unlimited
GCC 17.1	The following shall be designed by the Contractor: Detailed working drawings of the following: Structural drawings, Elevations, Layout plan, Electrical, Plumbing, Landscaping, boundary fencing, Sound & security system arrangement, Rain water harvesting & Renewable energy system plan, etc.
GCC 20.1	The Site Possession Date(s) shall be: the site shall be handed over to the contractor within 3 days from the date of issue of instruction of work commencement.
GCC 23.1	Appointing Authority for the Adjudicator: President, Institution of Engineers-Sikkim chapter. India.
GCC 24.4	Arbitrators will be selected from the Panel of Arbitrators from Construction Industry Arbitration Council/ Indian Institute of Engineers.
B. Time Control	
GCC 25.3	The amount to be withheld for late submission of an updated Program is an amount equal to 5 % of the next interim payments
C. Quality Control	

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GCC 33.1	The Defects Liability Period is: 1 year from the date of issue of Certificate of Completion.
D. Cost Control	
GCC 44.1	<p>Price Adjustment Clause is Not Applicable for the first 18 months. After 18 months, the price adjustment is applicable and payable to the Contractor, in accordance with the Contract, subject to adjustment during performance of the Contract to reflect changes in the cost of labor and material components, in accordance with the following formula:</p> $P_1 = P_0 \times \left(a + b \frac{L_1}{L_0} + c \frac{M_1}{M_0} \right) - P_0$ <p>in which:</p> <p>P1 = adjustment amount payable to the Contractor</p> <p>P0 = Contract price (base price)</p> <p>a = percentage of fixed element in Contract price (a =25 %)</p> <p>b = percentage of labor component in Contract price (b = % as given table below)</p> <p>c = percentage of material and equipment component in Contract price (c = % as given in table below)</p> <p>L0, L1 = labor indices applicable i.e. consumer price index for industrial workers provided by Guwahati Centre of Labour Bureau Of Government of India on the base date and the date for adjustment, respectively labour</p> <p>M0, M1= For material and equipment index will be wholesale price index of all commodities published by RBI on the base date and the date for adjustment, respectively.</p> <p>Table showing percentage of material and labour component</p> <p>For General Civil Works Labor PL = 22.5% and Materials PM = 52.5%</p>

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<p>GCC 45.1 &</p> <p>GCC 45.2</p>	<p>The proportion of payments retained from each payment shall be 10% (ten percent) of the payment amount, as Retention Money. No interest will be paid for the retention money.</p> <p>50% of retention money will be paid upon issue of Certificate of Completion and remaining 50% upon completion of defect liability period. The Contractor may substitute retention money with an “unconditional” bank guarantee.</p>
<p>GCC 46.1</p>	<p>In the event that the contractor fails to comply with the Intended Time of completion for the whole of the Works, or, if applicable, any section within the relevant time, then the Contractor shall pay liquidated damage to the Employer at the rate of 0.1% (one percent) per day. The maximum amount of liquidated damages for the whole of the works is 10% (ten percent) of the final contract price. Whether the asset is put to use or not the Liquidated Damages will be levied for any delay in completion of works as a part of commitment on the part of the contractor.</p>
<p>GCC 47</p>	<p>Bonus : Not Applicable</p>
<p>GCC 48.1</p>	<p>The Advance Payments shall be: 5 % of the Contract Amount and shall be paid to the Contractor no later than 21 days after the submission of the required Bank Guarantee issued by a Nationalized Bank/Scheduled Bank. The mobilization advance cannot be claimed after the expiry of 4 months from the date of agreement of this contract.</p>
<p>GCC 48.3</p>	<p>The advance payment shall be recovered at a rate of minimum of 10 % (ten percent) of the amount of advance payment from the first and every subsequent bills until the full advance paid has been recovered. However the Project Manager has the liberty to recover more than 10 % amount if he feels the pattern of submission of bills of the contractor warrants deduction of more amount for recovery of advance amount. If the advance amount is not recovered fully before the intended time of completion, penalty interest @ 8% will be recovered for the outstanding amount.</p>
<p>GCC 49.1</p>	<p>The Performance Security in the form unconditional and irrevocable bank guarantee issued by a Nationalized Bank/Scheduled Bank located in India for an amount of 10 % of the Contract price. The performance security shall</p>

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	be valid up to 28 days beyond completion of defect liability period.
E. Finishing the Contract	
GCC 56.2(b)	The contractor has to approach the Project Manager at least 5 days before the expiry of time period of 28 days to get the revised instructions.
GCC 56.2 (g)	The maximum number of days is: 100 days.
GCC 58.1	The percentage to apply to the value of the work not completed, representing the Employer's additional cost for completing the Works, is 20%.

Appendix-1 Environmental Monitoring Plan

(Deleted)

Appendix-2 Environmental Management Plan

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation
Sources of Materials	Extraction of rocks and material may cause ground instability	<p>(i) Use quarry sites and sources permitted by government;</p> <p>(ii) Verify suitability of all material sources and obtain approval of GSCDL</p> <p>(iii) Submit to GSCDL on a monthly basis documentation of sources of materials.</p>	Construction Contractor	Construction Contractor documentation
Air Quality	Emissions from construction vehicles, equipment, and machinery used for excavation and construction resulting to dusts and increase in concentration of vehicle-related pollutants such as carbon monoxide, sulfur oxides, particulate matter, nitrous oxides, and hydrocarbons)	<p>(i) Consult with GSCDL on the designated areas for stockpiling of clay, soils, gravel, and other construction materials;</p> <p>(ii) Damp down exposed soil and any stockpiled on site by spraying with water when necessary during dry weather;</p> <p>(iii) Bring materials (aggregates) as and when required;</p> <p>(iv) Use tarpaulins to cover sand and other loose material when transported by vehicles;</p> <p>(v) Fit all heavy equipment and machinery with air pollution control devices which are operating correctly; and</p>	Construction Contractor	<p>(i) Location of stockpiles;</p> <p>(ii) Complaints from sensitive receptors;</p> <p>(iii) Heavy equipment and machinery with air pollution control devices;</p> <p>(iv) Ambient air for Respirable particulate matter (RPM) and suspended particulate matter (SPM);</p> <p>(v) Vehicular emissions such as sulphur dioxide (SO₂), nitrous oxides</p>

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Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation
		(vi) Clean wheels and undercarriage of vehicles prior to leaving construction site.		(NOx), carbon monoxide (CO), and hydrocarbons
Surface water quality	Mobilization of settled silt materials, run-off from stockpiled materials, and chemical contamination from fuels and lubricants during construction works can contaminate nearby surface water quality.	<p>(i) Avoid stockpiling of earth fill especially during the monsoon season unless covered by tarpaulins or plastic sheets;</p> <p>(ii) Prioritize re-use of excess spoils and materials in the construction works. If spoils will be disposed, consult with GSCDL on designated disposal areas;</p> <p>(iii) Install temporary silt traps or sedimentation basins along the drainage leading to the water bodies;</p> <p>(iv) Place storage areas for fuels and lubricants away from any drainage leading to water bodies;</p> <p>(v) Dispose any wastes generated by construction activities in designated sites; and</p> <p>(vi) Conduct surface quality inspection according to the Environmental Management Plan (EMP).</p>	Construction Contractor	<p>(i) Areas for stockpiles, storage of fuels and lubricants and waste materials;</p> <p>(ii) Number of silt traps installed along drainages leading to water bodies;</p> <p>(iii) Records of surface water quality inspection;</p> <p>(iv) Effectiveness of water management measures;</p> <p>(v) For inland water: suspended solids, oil and grease, biological oxygen demand (BOD), and coliforms.</p>
Noise Levels	Increase in noise level due to earth-moving and excavation equipment, and the transportation of	(i) Plan activities in consultation with GSCDL so that activities with the greatest potential to generate	Construction Contractor	<p>(i) Complaints from sensitive receptors;</p> <p>(ii) Use of</p>

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Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation
	equipment, materials, and people	<p>noise are conducted during periods of the day which will result in least disturbance;</p> <p>(ii) Provide prior information to the local public about the work schedule;</p> <p>(iii) Require horns not be used unless it is necessary to warn other road users or animals of the vehicle's approach;</p> <p>(iv) Minimize noise from construction equipment by using vehicle silencers, fitting jackhammers with noise-reducing mufflers, and portable street barriers the sound impact to surrounding sensitive receptor; and</p> <p>(vi) Maintain maximum sound levels not exceeding 80 decibels (dbA) when measured at a distance of 10 m or more from the vehicle/s.</p>		<p>silencers in noise-producing equipment and sound barriers;</p> <p>(iii) Equivalent day and night time noise levels</p>
Socio-Economic – Employment and income	Generation of contractual employment and increase in local revenue	<p>(i) Employ at least 50% of the labour force, or to the maximum extent, local persons within the 2-km immediate area if manpower is available; and</p> <p>(ii) Secure construction materials from local market.</p>	Construction Contractor	<p>(i) Employment records;</p> <p>(ii) records of sources of materials</p>
Occupational Health and Safety	Occupational hazards which can arise during work	(i) Develop and implement site-specific Health and Safety (H and S) Plan which will include measures such	Construction Contractor	(i) Site-specific Health and Safety (H and S)

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Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation
		<p>as: (a) excluding public from the site; (b) ensuring all workers are provided with and use Personal Protective Equipment; (c) H and S Training for all site personnel; (d) documented procedures to be followed for all site activities; and (e) documentation of work-related accidents;</p> <p>(ii) Ensure that qualified first-aid can be provided at all times. Equipped first-aid stations shall be easily accessible throughout the site;</p> <p>(iii) Provide medical insurance coverage for workers;</p> <p>(iv) Secure all installations from unauthorized intrusion and accident risks;</p> <p>(v) Provide supplies of potable drinking water;</p> <p>(vi) Provide clean eating areas where workers are not exposed to hazardous or noxious substances;</p> <p>(vii) Provide H and S orientation training to all new workers to ensure that they are apprised of the basic site rules of work at the site, personal protective protection, and preventing injuring to fellow workers;</p>		<p>Plan;</p> <p>(ii) Equipped first-aid stations;</p> <p>(iii) Medical insurance coverage for workers;</p> <p>(iv) Number of accidents;</p> <p>(v) Supplies of potable drinking water;</p> <p>(vi) Clean eating areas where workers are not exposed to hazardous or noxious substances;</p> <p>(vii) record of H and S orientation trainings</p> <p>(viii) personal protective equipments;</p> <p>(ix) % of moving equipment outfitted with audible back-up alarms;</p> <p>(xi) sign boards for hazardous areas such as energized electrical devices and lines,</p>

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Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation
		<p>(viii) Provide visitor orientation if visitors to the site can gain access to areas where hazardous conditions or substances may be present. Ensure also that visitor/s do not enter hazard areas unescorted;</p> <p>(ix) Ensure the visibility of workers through their use of high visibility vests when working in or walking through heavy equipment operating areas;</p> <p>(x) Ensure moving equipment is outfitted with audible back-up alarms;</p> <p>(xi) Mark and provide sign boards for hazardous areas such as energized electrical devices and lines, service rooms housing high voltage equipment, and areas for storage and disposal. Signage shall be in accordance with international standards and be well known to, and easily understood by workers, visitors, and the general public as appropriate; and</p> <p>(xii) Disallow worker exposure to noise level greater than 85 dBA for a duration of more than 8 hours per day without hearing protection. The use of hearing protection shall be enforced actively.</p>		<p>service rooms housing high voltage equipment, and areas for storage and disposal.</p>

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Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation
Quarry Sites and Borrow Pits	Extraction of approximately 8575 m ³ of clay, 476.4 m ³ of sand, 22282 m ³ of stones, 952.8 m ³ of coarse aggregates, and loose materials other than stones can cause disruption of natural land contours and vegetation resulting in accelerated erosion, landslides, disturbance in natural drainage patterns, sedimentation/siltation of surface waters, and water pollution.	<p>(i) Verify suitability of all material sources and obtain approval of GSCDL;</p> <p>(ii) Prioritize government-approved quarries and borrow pits;</p> <p>(iii) Obtain approval of GSCDL if new quarries and borrow sites are necessary;</p> <p>(iv) Obtain approval of GSCDL if extracting rocks, gravel, and sand from small rivers or streams is necessary. The extraction points shall be spread out along the length of the river to minimize disruption in river flow and to prevent instability to embankments. Local residents and water users shall be consulted to ensure that irrigation intakes, bunds, and local fishing are not adversely impacted; and</p> <p>(v) Request GSCDL to report in writing that the necessary environmental restoration work has been adequately performed before acceptance of work.</p>	Construction contractor	<p>(i) List of approved quarry sites and borrow pits;</p> <p>(ii) GSCDL/PDMC report in writing that all necessary environmental restoration work has been adequately performed before acceptance of work.</p>
Work Camps	Temporary air and noise pollution from machine operation, water pollution from storage and use of fuels, oils, solvents, and lubricants	<p>(i) Consult with GSCDL before locating project offices, sheds, and construction plants;</p> <p>(ii) Minimize removal of vegetation and disallow</p>	Construction Contractor	<p>(i) Complaints from sensitive receptors;</p> <p>(ii) Water and sanitation facilities for</p>

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Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation
		<p>cutting of trees;</p> <p>(iii) Provide water and sanitation facilities for employees;</p> <p>(iv) Prohibit employees from poaching wildlife and cutting of trees for firewood;</p> <p>(v) Train employees in the storage and handling of materials which can potentially cause soil contamination;</p> <p>(vi) Recover used oil and lubricants and reuse or remove from the site;</p> <p>(vii) Manage solid waste according to the following preference hierarchy: reuse, recycling and disposal to designated areas;</p> <p>(viii) Remove all wreckage, rubbish, or temporary structures which are no longer required; and</p> <p>(ix) Request GSCDL to report in writing that the camp has been vacated and restored to pre-project conditions before acceptance of work.</p>		<p>employees; and</p> <p>(iii) GSCDL/PDMC report in writing that the camp has been vacated and restored to pre-project conditions</p>
Social and Cultural Resources – Chance Finds	Risk of archaeological chance finds	<p>(i) Strictly follow the protocol for chance finds in any excavation work;</p> <p>(ii) Request GSCDL or any authorized person with archaeological/historical field</p>	Construction Contractor	Records of chance finds

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Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation
		<p>training to observe excavation;</p> <p>(iii) Stop work immediately to allow further investigation if any finds are suspected; and</p> <p>(iv) Inform GSCDL if a find is suspected, and take any action they require ensuring its removal or protection in situ.</p>		

Section 9 - CONTRACT FORMS

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

Letter of Acceptance

---- on letterhead paper of the Employer ----

..... *date*

To: *name and address of the Contractor*

Subject: *Notification of Award Contract No.*

Dear Sirs

This is to notify you that your Bid dated *date* for
.....
Gangtok, Sikkim or the Contract Price of Rupees
....., *amounting numbers and words* as corrected and modified in accordance with the
Instructions to Bidders* is hereby accepted by our Agency.

We accept/ do not accept thatbe appointed as
the Adjudicator **.

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

OR

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

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[delete whichever is not applicable]

You are hereby requested to furnish the Performance Security, plus additional security for unbalance bids in terms of ITB clause 43.1, in the form detailed in Para 37.5 of ITB for an amount of INR.
. within 15 days of the receipt of this letter of acceptance valid up to 28 days from the date of expiry of Defects Liability Period i.e.: unto and sign the contract, failing which action as stated in Para 43.2 of ITB will be taken.

We have reviewed the construction methodology submitted by you along with the bid in response to section IV and our comments are given in the attachment. You are requested to submit a revised Program including environmental management plan as per Clause 25 of General Conditions of Contract within 14 days of receipt of this letter.

Yours Faithfully

Authorized Signature:

Name and Title of Signatory:

Name of Agency:

* - delete "corrected and" or "and modified" if only one of these actions applies. Delete "as corrected and modified in accordance with the Instructions to Bidders" if corrections or modifications have not been effected.

** - to be used only if the Contractor disagrees in his Bid with the Adjudicator proposed by the Employer".

Contract Agreement

THIS AGREEMENT made theday of,, between Chief Executing Officer, GSCDL, Sokaythang, Gangtok-737102, Sikkim (India) (here in after “the Employer”), of the one part, and name of the Contractor.(hereinafter “the Contractor”), of the other part:

WHEREAS the Employer desires that the Works known as **CONSTRUCTION OF CULTURAL AND CONVENTION CENTRE AT GANGTOK, SIKKIM INCLUDING DEFECT LIABILITY PERIOD OF ONE YEAR**, should be executed by the Contractor, and has accepted a Bid by the Contractor for the execution and completion of these Works and the remedying of any defects therein,

The Employer and the Contractor agree as follows:

1. ***In this Agreement words and expressions shall have the same meanings as are respectively assigned to them in the Contract documents referred to.***
2. ***The following documents shall be deemed to form and be read and construed as part of this Agreement. This Agreement shall prevail over all other Contract documents.***
 - a) the Letter of Acceptance
 - b) Letters of Technical Bid and Price Bid
 - c) The Addenda Nos *insert addenda numbers if any.*
 - d) the Particular Conditions
 - e) the General Conditions;
 - f) the Specification
 - g) the Drawings; and
 - h) the completed Schedules,
3. ***In consideration of the payments to be made by the Employer to the Contractor as indicated in this Agreement, the Contractor hereby covenants with the Employer to execute the Works and to remedy defects therein in conformity in all respects with the provisions of the Contract.***
4. ***The Employer hereby covenants to pay the Contractor in consideration of the execution and completion of the Works and the remedying of defects therein, the Contract Price or such other sum as may become payable under the provisions of the Contract at the times and in the manner prescribed by the Contract.***

IN WITNESS whereof the parties hereto have caused this Agreement to be executed in accordance with the laws of Sikkimon the day, month and year indicated above.

PART III: CONDITIONS OF CONTRACT AND CONTRACT FORMS

Signed by

Signed by

for and on behalf of the Employer

for and on behalf the Contractor

in the presence of:

in the presence of:

Witness, Name, Signature, Address, Date

Witness, Name, Signature, Address, Date

Unconditional Performance Security

Bank's Name, and Address of Issuing Branch or Office

Beneficiary:

Name of the Employer: Gangtok Smart City Development Limited represented by the Chief Executing Officer, Sokaythang, Gangtok-737102, Sikkim (India)

Date:

Performance Guarantee No.:

We have been informed that name of the Contractor. (here in after called "the Contractor") has entered into Contract No. reference number of the Contract. datedwith you, for the **CONSTRUCTION OF CULTURAL AND CONVENTION AT GANGTOK, SIKKIM INCLUDING DEFECT LIABILITY PERIOD OF ONE YEAR**, (hereinafter called "the Contract").

Furthermore, we understand that, according to the conditions of the Contract, an irrevocable and unconditional performance guarantee is required.

At the request of the Contractor, we *name of the Bank*. hereby unconditionally and irrevocably undertake to pay you any sum or sums not exceeding in total an amount of *name of the currency and amount in figures*. (*amount in words*.) such sum being payable in the types and proportions of currencies in which the Contract Price is payable, upon receipt by us of your first demand in writing accompanied by a written statement stating that the Contractor is in breach of its obligation(s) under the Contract, and without cavil & arguments without your needing to prove or to show grounds for your demand or the sum specified therein.

This guarantee shall expire, no later than the Day of *Insert the date twenty-eight days after the defect liability period*. , and any demand for payment under it must be received by us at this office on or before that date.

The Guarantor agrees to a one-time extension of this guarantee for a period not to exceed [one year], in response to the Employer's written request for such extension, such request to be presented to the Guarantor before the expiry of the guarantee

.....
Seal of Bank and Signature(s)

Advance Payment Security (Unconditional)

Bank's Name, and Address of Issuing Branch or Office

Beneficiary:

Name of the Employer: Gangtok Smart City Development Limited represented by the Chief Executing Officer, Sokaythang, Gangtok-737102, Sikkim (India)

Date:

Advance Payment Guarantee No.:

We have been informed that name of the Contractor. (hereinafter called "the Contractor") has entered into Contract No. reference number of the Contract. dated with you, for the **CONSTRUCTION OF CULTURAL AND CONVENTION AT GANGTOK, SIKKIM INCLUDING DEFECT LIABILITY PERIOD OF ONE YEAR**, (hereinafter called "the Contract").

Furthermore, we understand that, according to the Conditions of the Contract, an advance payment in the sum *name of the currency and amount in figures*. (*amount in words*.) is to be made against an advance payment guarantee.

At the request of the Contractor, we *name of the Bank*. hereby unconditionally and irrevocably undertake to pay you any sum or sums not exceeding in total an amount of *name of the currency and amount in figures**. (*amount in words*.) upon receipt by us of your first demand in writing accompanied by a written statement stating that the Contractor is in breach of its obligation under the Contract because the Contractor used the advance payment for purposes other than the costs of mobilization in respect of the Works.

It is a condition for any claim and payment under this guarantee to be made that the advance payment referred to above must have been received by the Contractor on its account number *Contractor's account number*. at *name and address of the Bank*.

The maximum amount of this guarantee shall be progressively reduced by the amount of the advance payment repaid by the Contractor as indicated in copies of interim statements or payment certificates which shall be presented to us. This guarantee shall expire upon our receipt of a copy of the payment certificate indicating that hundred (100) percent mobilization advance has been recovered. This guarantee will not be subjected to any cavil or arguments.

The Guarantor agrees to a one-time extension of this guarantee for a period not to exceed [one year], in response to the Employer's written request for such extension, such request to be presented to the Guarantor before the expiry of the guarantee

..... **Seal of Bank and Signature(s)**

UNCONDITIONAL BANK GUARANTEE IN LIEU OF RETENTION MONEY

To: Gangtok Smart City Development Limited represented by the Chief Executing Officer, Sokaythang, Gangtok-737102, Sikkim (India)

WHEREAS _____ [name and address of contractor] (hereinafter called the "Contractor") has undertaken, in pursuance of Contract No. _____ dated _____ to **CONSTRUCTION OF CULTURAL AND CONVENTION AT GANGTOK, SIKKIM INCLUDING DEFECT LIABILITY PERIOD OF ONE YEAR,**

(herein after called the "Contract".);

AND WHEREAS IT HAS BEEN AGREED BY YOU IN THE SAID contract that the Contractor has option to replace the Retention Money with an irrevocable and unconditional Bank Guarantee, in instalments of _____ (*indicate the value*) from a Bank acceptable to you as security for compliance with contractor's obligations in accordance with the contract (Sub-clause 45.2 of Particular Conditions of Contract).

AND WHEREAS the Contractor has opted to replace the retention money with an irrevocable and unconditional Bank Guarantee;

NOW THEREFORE we hereby affirm that we are the Guarantor and responsible to you, on behalf of the Contractor, up to a total of _____ [*amount of Guarantee in figures*], _____ [*amount in words*],#such sum being payable in the types and proportions of currencies in which the Contract Price is payable, and we undertake to pay you, upon your first written demand and without cavil or argument, any sum or sums within the limits of _____ [*amount of Guarantee*] as aforesaid without your needing to prove or to show grounds or reasons for your demand for the sum specified therein.

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

PART III: CONDITIONS OF CONTRACT AND CONTRACT FORMS

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

This guarantee shall be valid till the 'Project Manager' certifies repayment of retention money in accordance with Sub-clause 45.2 of Particular Conditions of Contract i.e., upto

SIGNATURE AND SEAL OF THE GUARANTOR

Name of the Bank: _____

Address: _____

Date: _____

An amount is to be inserted by the Guarantor, representing the amount specified in the Contract, and denominated either in the currency(ies) of the Contract or in a freely convertible currency acceptable to the Employer.

Appendix 1

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation
Sources of Materials	Extraction of rocks and material may cause ground instability	<p>(i) Use quarry sites and sources permitted by government;;</p> <p>(ii) Verify suitability of all material sources and obtain approval of Gangtok Smart City Development Limited (GSCDL)and</p> <p>(iii) Submit to GSCDL on a monthly basis documentation of sources of materials.</p>	Construction Contractor	Construction Contractor documentation
Air Quality	Emissions from construction vehicles, equipment, and machinery used for excavation and construction resulting to dusts and increase in concentration of vehicle-related pollutants such as carbon monoxide, sulfur oxides, particulate matter, nitrous oxides, and hydrocarbons)	<p>(i) Consult with GSCDL on the designated areas for stockpiling of clay, soils, gravel, and other construction materials;</p> <p>(ii) Excavate the SRs foundations at the same time as the access roads (if needed) are built so that dug material is used immediately, avoiding the need to stockpile on site;</p> <p>(iii) Damp down exposed soil and any stockpiled on site by spraying with water when necessary during dry weather;</p> <p>(iv) Bring materials (aggregates) as and when required;</p> <p>(v) Use tarpaulins to cover sand and other loose material when transported by vehicles;</p> <p>(vi) Fit all heavy equipment and machinery with air pollution control devices which are operating correctly; and</p> <p>(vii) Clean wheels and</p>	Construction Contractor	<p>(i) Location of stockpiles;</p> <p>(ii) Complaints from sensitive receptors;</p> <p>(iii) Heavy equipment and machinery with air pollution control devices;</p> <p>(iv) Ambient air for respirable particulate matter (RPM) and suspended particulate matter (SPM);</p> <p>(v) Vehicular emissions such as</p>

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Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation
		undercarriage of vehicles prior to leaving construction site.		sulphur dioxide (SO ₂), nitrous oxides (NO _x), carbon monoxide (CO), and hydrocarbons
Surface water quality	Mobilization of settled silt materials, run-off from stockpiled materials, and chemical contamination from fuels and lubricants during construction works can contaminate nearby surface water quality.	<p>(i) Avoid stockpiling of earth fill especially during the monsoon season unless covered by tarpaulins or plastic sheets;</p> <p>(ii) Prioritize re-use of excess spoils and materials in the construction works. If spoils will be disposed, consult with GSCDL on designated disposal areas;</p> <p>(iii) Install temporary silt traps or sedimentation basins along the drainage leading to the water bodies;</p> <p>(iv) Place storage areas for fuels and lubricants away from any drainage leading to water bodies;</p> <p>(v) Dispose any wastes generated by construction activities in designated sites; and</p> <p>(vi) Conduct surface quality inspection according to the Environmental Management Plan (EMP).</p>	Construction Contractor	<p>(i) Areas for stockpiles, storage of fuels and lubricants and waste materials;</p> <p>(ii) Number of silt traps installed along drainages leading to water bodies;</p> <p>(iii) Records of surface water quality inspection;</p> <p>(iv) Effectiveness of water management measures;</p> <p>(v) For inland water: suspended solids, oil and grease, biological oxygen demand (BOD), and coliforms.</p>

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Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation
Noise Levels	Increase in noise level due to earth-moving and excavation equipment, and the transportation of equipment, materials, and people	<p>(i) Plan activities in consultation with GSCDL so that activities with the greatest potential to generate noise are conducted during periods of the day which will result in least disturbance;</p> <p>(ii) Provide prior information to the local public about the work schedule;</p> <p>(iii) Require horns not be used unless it is necessary to warn other road users or animals of the vehicle's approach;</p> <p>(iv) Ensure that there are no old and sensitive buildings that may come under risk due to the use of pneumatic drills; if there is risk, cut the rocks manually by chiselling;</p> <p>(v) Minimize noise from construction equipment by using vehicle silencers, fitting jackhammers with noise-reducing mufflers, and portable street barriers the sound impact to surrounding sensitive receptor; and</p> <p>(vi) Maintain maximum sound levels not exceeding 80 decibels (dbA) when measured at a distance of 10 m or more from the vehicle/s.</p>	Construction Contractor	<p>(i) Complaints from sensitive receptors;</p> <p>(ii) Use of silencers in noise-producing equipment and sound barriers;</p>
Landscape and Aesthetics	Solid wastes as well as excess construction materials	<p>(i) Avoid stockpiling of excess excavated soils;</p> <p>(ii) Avoid disposal of any debris and waste soils in the forest areas and in or near water bodies/rivers;</p> <p>(iii) Coordinate with GMC for beneficial uses of excess excavated soils or immediately dispose to</p>	Construction Contractor	<p>(i) Complaints from sensitive receptors;</p> <p>(ii) GSCDL/PDM C to report in</p>

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Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation
		designated areas; (iv) Manage solid waste according to the following preference hierarchy: reuse, recycling and disposal to designated areas; and (v) Request GSCDL/PDMC to report in writing that the necessary environmental restoration work has been adequately performed before acceptance of work.		writing that the necessary environmental restoration work has been adequately performed before acceptance of work.
Accessibility	Traffic problems and conflicts near project locations and haul road	(i) Plan pipeline work in consultation with the traffic police; (ii) Conduct work during light traffic; (iii) Plan work such that trench excavation, pipe laying, and refilling including compacting, at a stretch is completed in a minimum possible time; (iv) Provide for immediate consolidation of backfilling material to desired compaction to avoid future settlement risk - this will allow immediate road restoration and therefore will minimise disturbance to the traffic movement; (v) Do not close the road completely, ensure that work is conducted onto edge of the road; allow traffic to move on one line; (vi) In unavoidable circumstances of road closure, provide alternative routes, and ensure that public is informed about such traffic diversions; (vii) In case of closure of main roads, provide information to the	Construction Contractor	(i) Traffic Management measures; (ii) Complaints from sensitive receptors; (iii) Number of signages placed at subproject location.

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Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation
		<p>public through media – daily newspapers and local cable television (TV) services, about the need and schedule of road closure, and alternative routes;</p> <p>(viii) At all work sites public information/caution boards shall be provided – information shall inter-alia include: project name, cost and schedule; executing agency and contractor details; nature and schedule of work at that road/locality; traffic diversion details, if any; entry restriction information; competent official’s name and contact for public complaints.</p>		
Socio-Economic – Income.	Impede the access of residents and customers to nearby shops	<p>(i) Leave space for access between mounds of excavated soil;</p> <p>(ii) Provide wooden planks/footbridges for pedestrians and metal sheets for vehicles to allow access across trenches to premises where required;</p> <p>(iii) Consult affected businesspeople to inform them in advance when work will occur;</p> <p>(iv) Provide prior public information about the work schedule in particular locality and the traffic diversions/changes in any – information shall disseminated through local papers and cable television services;</p> <p>(v) Provide sign/caution/warning boards at work site indicating work schedule and traffic information; prevent public entry into work sites through barricading and security; and</p>	Construction Contractor	<p>(i) Complaints from sensitive receptors;</p> <p>(ii) Number of walkways, signages, and metal sheets placed at subproject location.</p>

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Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation
		(vi) Provide sign boards for pedestrians to inform nature and duration of construction works and contact numbers for concerns/complaints.		
Socio-Economic - Employment	Generation of contractual employment and increase in local revenue	(i) Employ at least 50% of the labour force, or to the maximum extent, local persons if manpower is available; and (ii) Secure construction materials from local market.	Construction Contractor	(i) Employment records; (ii) records of sources of materials
Occupational Health and Safety	Occupational hazards which can arise during work	(i) Implement measures such as: (a) excluding public from the site; (b) ensuring all workers are provided with and use Personal Protective Equipment; (c) H and S Training for all site personnel; (d) documented procedures to be followed for all site activities; and (e) documentation of work-related accidents; (ii) Ensure that qualified first-aid can be provided at all times. Equipped first-aid stations shall be easily accessible throughout the site; (iii) Secure all installations from unauthorized intrusion and accident risks; (iv) Provide supplies of potable drinking water; (v) Provide clean eating areas where workers are not exposed to hazardous or noxious substances; (vi) Provide H and S orientation training to all new workers to ensure	Construction Contractor	(i) Site-specific Health and Safety (H and S) Plan; (ii) Equipped first-aid stations; (iii) Number of accidents; (iv) Supplies of potable drinking water; (vi) Clean eating areas where workers are not exposed to hazardous or noxious substances; (vii) record of H and S orientation

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Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation
		<p>that they are apprised of the basic site rules of work at the site, personal protective protection, and preventing injuring to fellow workers;</p> <p>(vii) Provide visitor orientation if visitors to the site can gain access to areas where hazardous conditions or substances may be present. Ensure also that visitor/s do not enter hazard areas unescorted;</p> <p>(viii) Ensure the visibility of workers through their use of high visibility vests when working in or walking through heavy equipment operating areas;</p> <p>(ix) Ensure moving equipment is outfitted with audible back-up alarms;</p> <p>(x) Mark and provide sign boards for hazardous areas such as energized electrical devices and lines, service rooms housing high voltage equipment, and areas for storage and disposal. Signage shall be in accordance with international standards and be well known to, and easily understood by workers, visitors, and the general public as appropriate; and</p> <p>(xi) Disallow worker exposure to noise level greater than 85 dBA for a duration of more than 8 hours per day without hearing protection. The use of hearing protection shall be enforced actively.</p>		<p>trainings</p> <p>(viii) personal protective equipments;</p> <p>(ix) % of moving equipment outfitted with audible back-up alarms;</p> <p>(x) sign boards for hazardous areas such as energized electrical devices and lines, service rooms housing high voltage equipment, and areas for storage and disposal.</p>
Community Health and Safety.	Traffic accidents and vehicle collision with pedestrians during material	<p>The construction contractor will be required to:</p> <p>(i) Plan routes to avoid times of peak-pedestrian activities.</p>	Construction Contractor	(i) Traffic Management Measures;

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Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation
	and waste transportation	<p>(ii) Liaise with GSCDL in identifying risk areas on route cards/maps.</p> <p>(iii) Maintain regularly the vehicles and use of manufacturer-approved parts to minimize potentially serious accidents caused by equipment malfunction or premature failure.</p> <p>(iv) Provide road signs and flag persons to warn of dangerous conditions, in case of location near the road.</p>		(ii) Complaints from sensitive receptors
Work Camps	Temporary air and noise pollution from machine operation, water pollution from storage and use of fuels, oils, solvents, and lubricants	<p>(i) Consult with GSCDL before locating project offices, sheds, and construction plants;</p> <p>(ii) Minimize removal of vegetation and disallow cutting of trees;</p> <p>(iii) Provide water and sanitation facilities for employees;</p> <p>(iv) Prohibit employees from poaching wildlife and cutting of trees for firewood;</p> <p>(v) Train employees in the storage and handling of materials which can potentially cause soil contamination;</p> <p>(vi) Recover used oil and lubricants and reuse or remove from the site;</p> <p>(vii) Manage solid waste according to the following preference hierarchy: reuse, recycling and disposal to designated areas;</p>	Construction Contractor	<p>(i) Complaints from sensitive receptors;</p> <p>(ii) Water and sanitation facilities for employees; and</p> <p>(iii) GSCDL/PDM C report in writing that the camp has been vacated and restored to pre-project conditions</p>

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Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation
		<p>(viii) Remove all wreckage, rubbish, or temporary structures which are no longer required; and</p> <p>(ix) Request GSCDL to report in writing that the camp has been vacated and restored to pre-project conditions before acceptance of work.</p>		
<p>Social and Cultural Resources –</p>	<p>Disturbance/inc onvenience/ damage due to construction</p>	<p>(i) Consult the city authorities to identify any buildings at risk from vibration damage and avoiding any use of pneumatic drills or heavy vehicles in the vicinity;</p> <p>(ii) Complete work in these areas quickly;</p> <p>(iii) Consult municipal authorities, custodians of important buildings, cultural and tourism authorities and local communities in advance of the work to identify and address key issues, and avoid working at sensitive times, such as religious and cultural festivals.</p>	<p>Construction Contractor</p>	<p>(i) Work Schedule</p> <p>(ii) Complaints from sensitive receptors</p>