Invitation for Bids (IFB)  
(ADB Loan No: 3223 – IND)  

Infrastructure Development Investment Program for Tourism (Project 3) Uttarakhand [IDIPT-UK]  

Date of Issue : 28th December 2015  
NCB Invitation for Bids No. : IDIPT (UK)/T3/NCB/W/07/R1/2014-15  
NCB Package No : UK/IDIPT-III/ DDN/ 02  
NCB Contract Name : Development of Tourism Infrastructure in Kartikeya Swami Circuit - Kartikeya Swami Temple  
Deadline for Submission of Bid : 28th January 2016  

1. Govt. of India as the “Borrower” is in the process of receiving a loan from the Asian Development Bank (ADB) towards the cost of ‘Infrastructure Development Investment Program for Tourism’ [Project 3]. Part of this loan will be used for eligible payments under the Contract named above.  

2. Uttarakhand Tourism Development Board (UTDB), Department of Tourism, Government of Uttarakhand, the Implementing Agency is the “Employer” and invites National Competitive Bids (NCB) in sealed covers from eligible bidders for Construction and Completion of contract named above, on Item Rate Contract as detailed in the Bid Document.  

3. National Competitive Bidding (NCB) will be conducted in accordance with ADB’s “Single-Stage, Two-Envelope” Bidding Procedure and is open to all Bidders from eligible source countries of ADB (refer Section V).  

4. To be qualified under this package, the Bidder should meet the following minimum requirement (relevant supporting documents need to be attached with the bid);  

<table>
<thead>
<tr>
<th>S N</th>
<th>Qualifying Criteria</th>
<th>Minimum Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>General Construction experience</td>
<td>Not Less than 5 years</td>
</tr>
<tr>
<td>2.</td>
<td>Average Annual Construction Turnover (AAT) for the last three years</td>
<td>Equal to or more than INR 17.31 Million</td>
</tr>
<tr>
<td>3.</td>
<td>Should have completed at least one similar work, in the last 7 years, ending on the last day of the month previous to the one in which the tenders are invited; One similar works (of Value)</td>
<td>INR 17.31 Million</td>
</tr>
<tr>
<td>4.</td>
<td>Overall cash flow for this contract and its current contract commitment</td>
<td>INR 34.61 Million</td>
</tr>
</tbody>
</table>

However, for complete eligibility and qualification requirements refer to Section 3: Evaluation and Qualification of the bidding document.  

5. The Bidding Documents in English language may be purchased on submission of a written application to “The Program Director, IDIPT (Uttarakhand)” at the address given below, on payment of a non-refundable fee of INR 5000/= (Indian Rupees Five thousand only) between 10:00 Hrs to 17:00 Hrs from 28th December 2015 to 27th January 2016, excluding Holidays.  

(a) Bidders, who wish to receive the documents by courier, shall have to pay INR 3,000 (Indian Rupees Three Thousand only) in addition to the non-refundable document fee. The Employer will not be responsible for any damage / loss in transit and / or late delivery.  

(b) The Bidding Documents may also be downloaded from the Tourism Department website: [www.uttarakhandtourism.gov.in](http://www.uttarakhandtourism.gov.in).  

6. Interested Bidders may inspect the Bidding Document and obtain further information from “Office of the
7. In all cases, payment of document fee shall be made by Demand Draft, drawn in favour of “Program Director, Infrastructure Development Investment Program for Tourism”, payable at Dehradun. In case the Bidding Document is downloaded from the website, the document fee has to be paid along with the Bid as a separate instrument other than that of Bid Security.

8. Bids shall be delivered at the address below at or before 15:00 hours on 28th January 2016. Technical bid must be accompanied by a Bid Security in requisite form, for an amount as indicated in ITB 21.1 of Bid Data Sheet of section 2 of the Bid document. Bids received after due time and date of submission and without the Bid Security shall be rejected. Technical bids of the Bidders will only be opened on the same day at 15:30 Hrs in the presence of the Bidders’ representatives who choose to attend the meeting.

9. Financial Proposals of the qualified Bidders only will be opened after evaluation of the Technical Bids. Date of opening of the Financial Proposals will be intimated later.

10. The Employer will not be responsible for any costs or expenses incurred by Bidders in connection with the preparation or delivery of Bids. 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.

11. Bidders are encouraged to visit the site, before the pre-bid meeting /submission of bid. A site visit will be organized by the Employer, on 14th January 2016 at 10:00 Hrs. but no reimbursement will be made to the prospective bidders. Bidders interested in participating in the bids are advised to attend the same. The Employer will not be held responsible for any damage, injury/death of the participants during site visit or otherwise. The Employer will only provide permission for site visit by the Bidders/their Representatives. However, the interested Bidders are requested to intimate the details of the members who intend to visit site and participate Pre-Bid Meeting for providing arrangements by the Employer well in advance.

12. Pre-bid meeting will be held at Office of the Program Director (at the address provided) at 15:00 Hrs on 15th January 2016.

13. Any “Corrigendum” and / or “Addendum”, Clarification/s, if issued, will only be updated in the Tourism Department website, as mentioned above.

Mr. Asheesh Joshi
The Program Director,
Infrastructure Development Investment Program for Tourism, State of Uttarakhand IDIPT (UK),
Uttarakhand Tourism Development Board (UTDB)
Pandit Deendayal Uppadhaya Paryatan Bhawan, Dehradun, Uttarakhand – 248003, India
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Email: utdb.pmu@gmail.com, Website : www.uttarakhandtourism.gov.in
Uttarakhand Tourism Development Board
Government of Uttarakhand

Infrastructure Development Investment Program for Tourism (Project - 3)
ADB LOAN No: 3223 – IND

BIDDING DOCUMENT (REBID – 1)

For

Procurement of

Works of

Development of Tourism Infrastructure in Kartikeya Swami Circuit
- Kartikeya Swami Temple

(Following ADB’s Single Stage - Two Envelope Bidding Procedure)

Volume 1 - Technical Bid

Issued on : 28th December 2015
Invitation for Bid No : IDIPT (UK)/T3/NCB/W/07/R1/2014-15
Package No. : UK/IDIPT-III/ DDN/ 02

Employer : Uttarakhand Tourism Development Board (UTDB)

Represented by:

The Program Director
Program Management Unit (PMU),
Uttarakhand Tourism Development Board
Pandit Deendayal Upadhyaya Paryatan Bhawan,
Near ONGC Helipad, Garhi Cantt. Dehradun

Country : India
Invitation for Bid (IFB)
Preface

This Bidding Document for Procurement of Works has been prepared by Uttarakhand Tourism Development Board (UTDB) and is based on the Standard Bidding Document for “Procurement of Works, Small Contracts” issued by the Asian Development Bank dated March 2014.

ADB’s SBD Works-Small has the structure and the provisions of the Master Procurement Document entitled “Bidding Documents for the Procurement of Works–Small Contracts”, prepared by multilateral development banks and other public international financial institutions except where ADB-specific considerations have required a change.
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Section 2 - Bid Data Sheet (BDS)--------------------------------------------------------- 2-1
This Section consists of provisions that are specific to each procurement and supplement the information or requirements included in Section 1 - Instructions to Bidders.

Section 3 - Evaluation and Qualification Criteria (EQC) ------------------------------- 3-1
This Section contains the criteria to determine the lowest evaluated bid and the qualifications of the Bidder to perform the contract.

Section 4 - Bidding Forms (BDF)---------------------------------------------------------- 4-1
This Section contains the forms which are to be completed by the Bidder and submitted as part of his Bid.

Section 5 - Eligible Countries (ELC) ---------------------------------------------------- 5-1
This Section contains the list of eligible countries.

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This Section contains the Specification, the Drawings, Supplementary Information that describe the Works to be procured, the Personnel Requirements, and the Equipment Requirements.

PART III CONDITIONS OF CONTRACT AND CONTRACT FORMS

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This Section contains the general clauses to be applied in all contracts. These Conditions are subject to the variations and additions set out in Section 8 (Particular Conditions of Contract).

Section 8 - Particular Conditions of Contract (PCC) -------------------------------------- 8-1
This Section contains provisions which are specific to each contract and which modify or supplement the GCC. Whenever there is a conflict, the provisions herein shall prevail over those in the GCC.

Section 9 - Contract Forms (COF)--------------------------------------------------------- 9-1
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.
Section 1 - Instructions to Bidders

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Section 1 - Instructions to Bidders

A. General

1. Scope of Bid

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

1.2 Throughout this Bidding Document:

(a) the term “in writing” means communicated in written form and delivered against receipt;

(b) except where the context requires otherwise, words indicating the singular also include the plural and words indicating the plural also include the singular; and

(c) “day” means calendar day.

2. Source of Funds

2.1 The Borrower or Recipient (hereinafter called “Borrower”) indicated in the BDS has applied for or received financing (hereinafter called “funds”) from the Asian Development Bank (hereinafter called “ADB”) toward 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.

2.2 Payments by the ADB will be made only at the request of the Borrower and upon approval by the ADB in accordance with the terms and conditions of the financing agreement between the Borrower and the ADB (hereinafter called the Financing Agreement), and will be subject in all respects to the terms and conditions of that Financing Agreement. No party other than the Borrower shall derive any rights from the Financing Agreement or have any claim to the funds.

3. Fraud and Corruption

3.1 ADB’s Anticorruption Policy requires borrowers (including beneficiaries of ADB-financed activity), as well as Bidders, suppliers, and contractors under ADB-financed contracts, observe the highest standard of ethics during the procurement and execution of such contracts. In pursuance of this policy, ADB:

(a) 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 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;

(v) "integrity violation" means any act, as defined under ADB’s Integrity Principles and Guidelines, which violates ADB’s Anticorruption Policy including corrupt, fraudulent, coercive, or collusive practice, abuse, and obstructive practice;

(vi) "obstructive practice" means (a) deliberately destroying, falsifying, altering or concealing of evidence material to an ADB investigation; (b) making false statements to investigators in order to materially impede an ADB investigation; (c) failing to comply with requests to provide information, documents or records in connection with an OAI investigation; (d) threatening, harassing, or intimidating any party to prevent it from disclosing its knowledge of matters relevant to the investigation or from pursuing the investigation, or (e) materially impeding ADB’s contractual rights of audit or access to information.

(b) 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, coercive, or obstructive practices or other integrity violations in competing for the Contract;

(c) will cancel the portion of the financing allocated to a contract if it determines at any time that representatives of the borrower or of a beneficiary of ADB-financing engaged in corrupt, fraudulent, collusive, coercive, or obstructive practices or other integrity violations during the procurement or the execution of that contract, without the borrower having taken timely and appropriate action satisfactory to ADB to remedy the situation;

(d) will sanction impose remedial actions on a firm or an individual, at any time, in accordance with ADB’s Anticorruption Policy and Integrity Principles and Guidelines (both as amended from time to time), including declaring ineligible, either indefinitely or for a stated period of time, to participate\(^1\) in ADB-financed, or administered or supported activities or to benefit from an ADB-financed, administered or supported 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, coercive, or obstructive practices or other integrity violations; and

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\(^1\) Whether as a contractor, nominated subcontractor, consultant, manufacturer or supplier, or service provider; or in any other capacity (different names are used depending on the particular bidding document). A nominated subcontractor is one which either has been: (i) included by the bidder in its pre-qualification application or bid because it brings specific and critical experience and know-how that are accounted for in the evaluation of the bidder’s pre-qualification application or the bid; or (ii) appointed by the Employer.
3.2 Furthermore, Bidders shall be aware of the provisions of GCC 28.3 and 73.2 (i).

4. Eligible Bidders

4.1 A Bidder may be a natural person, private entity, government-owned entity – subject to ITB 4.5 – or any combination of them with a formal intent to enter into an agreement or under an existing agreement in the form of a Joint Venture (JV). In the case of a JV:

(a) all partners shall be jointly and severally liable, and

(b) 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 of the JV during the bidding process and, in the event the JV is awarded the Contract, during contract execution.

4.2 A Bidder, and all parties constituting the Bidder, shall have the nationality of an eligible country, in accordance with Section 5 (Eligible Countries). 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.

4.3 A Bidder shall not have a conflict of interest. All Bidders found to have a conflict of interest shall be disqualified. A Bidder may be considered to 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 material information about or improperly influence 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, either individually or as a partner in a joint venture, except for alternative offers permitted under ITB Clause 13 of the Bidding Document. This will result in the disqualification of all Bids in which it is involved. However, subject to any finding of a conflict of interest in terms of 4.3 (a) - (d) above, this does not limit the participation of a Bidder as a Subcontractor in another bide or of a firm as a Subcontractor in more than one bid; or
(f) a Bidder or any affiliated entity, participated as a Consultant in the preparation of the design or technical specifications of the works that are the subject of the Bid; or

(g) a Bidder was affiliated with a firm or entity that has been hired (or is proposed to be hired) by the Employer or Borrower as Engineer for the contract.

4.4 A firm shall not be eligible to participate in any procurement activities under an ADB-financed or ADB-supported project while under sanction by ADB pursuant to its Anticorruption Policy (see ITB 3), whether such sanction was directly imposed by ADB, or imposed by ADB pursuant to the Agreement for Mutual Enforcement of Debarment Decisions. A bid from a sanctioned or cross-debarred firm will be rejected.

4.5 Government-owned enterprises in the Employer’s country shall be eligible only if they can establish that they (i) are legally and financially autonomous, (ii) operate under commercial law, and that they (iii) are not a dependent agency of the Employer.

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

4.7 Firms shall be excluded if by an act of compliance with a decision of the United Nations Security Council taken under Chapter VII of the Charter of the United Nations, the Borrower’s country prohibits any import of goods or contracting of works or services from that country or any payments to persons or entities in that country.

4.8 In case a prequalification process has been conducted prior to the bidding process, this bidding is open only to prequalified Bidders.

5. **Eligible Materials, Equipment and Services**

5.1 The materials, equipment and services to be supplied under the Contract 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.

5.2 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.
B. Contents of Bidding Document

6. Sections of Bidding Document

6.1 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 - Eligible Countries (ELC)

PART II Requirements
- Section 6 - Employer’s Requirements (ERQ)

PART III Conditions of Contract and Contract Forms
- Section 7 - General Conditions of Contract (GCC)
- Section 8 - Particular Conditions of Contract (PCC)
- Section 9 - Contract Forms (COF)

6.2 The Invitation for Bids issued by the Employer is not part of the Bidding Document.

6.3 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.

6.4 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.

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

7.1 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 in accordance with ITB 6.3, 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.

7.2 The Bidder is advised to visit and examine the Site of Works and its surroundings and obtain for itself, on its own risk and responsibility, all information that may be necessary for preparing the bid and entering into a contract for construction of the Works. The costs of visiting the Site shall be at the Bidder’s own expense.

7.3 The Bidder and any of its personnel or agents will be granted permission by the Employer to enter upon its premises and lands for
the purpose of such visit, but only upon the express condition that the Bidder, its personnel, and agents will release and indemnify the Employer and its personnel and agents from and against all liability in respect thereof, and will be responsible for death or personal injury, loss of or damage to property, and any other loss, damage, costs, and expenses incurred as a result of the inspection.

7.4 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.

7.5 The Bidder is requested to submit any questions in writing, to reach the Employer not later than one week before the meeting.

7.6 Minutes of the pre-bid meeting, 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.

7.7 Nonattendance at the pre-bid meeting will not be a cause for disqualification of a Bidder.

8. Amendment of Bidding Document

8.1 At any time prior to the deadline for submission of bids, the Employer may amend the Bidding Document by issuing addenda.

8.2 Any addendum issued shall be part of the Bidding Document and shall be communicated in writing to all who have obtained the Bidding Document from the Employer in accordance with ITB 6.3.

8.3 To give prospective Bidders reasonable time in which to take an addendum into account in preparing their bids, the Employer may, at its discretion, extend the deadline for the submission of bids, pursuant to ITB 22.2.

C. Preparation of Bids

9. Cost of Bidding

9.1 The Bidder shall bear all costs associated with the preparation and submission of its Bid, and the Employer shall in no case be responsible or liable for those costs, regardless of the conduct or outcome of the bidding process.

10. Language of Bid

10.1 The Bid, as well as all correspondence and documents relating to the bid exchanged by the Bidder and the Employer, shall be written in the language specified in the BDS. Supporting documents and printed literature that are part of the Bid may be in another language provided they are accompanied by an accurate translation of the relevant passages in the language specified in the BDS, in which case, for purposes of interpretation of the Bid, such translation shall govern.
11. Documents Comprising the Bid

11.1 The Bid shall comprise two 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.

11.2 The Technical Bid shall comprise the following:
   (a) Letter of Technical Bid;
   (b) Bid Security or Bid Securing Declaration, in accordance with ITB 19;
   (c) alternative bids, at Bidder’s option and if permissible, in accordance with ITB 13;
   (d) written confirmation authorizing the signatory of the Bid to commit the Bidder, in accordance with ITB 20.2;
   (e) documentary evidence in accordance with ITB 17 establishing the Bidder’s qualifications to perform the contract;
   (f) Technical Proposal in accordance with ITB 16;
   (g) 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) alternative price bids, at Bidder’s option and if permissible, in accordance with ITB 13;
   (d) Any other document required in the BDS.

11.4 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 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.

12. Letters of Bid and Schedules

12.1 The Letters of Technical Bid and Price Bid, and the Schedules, and all documents listed under Clause 11, shall be prepared using the relevant forms furnished in Section 4 (Bidding Forms). 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.

13. Alternative Bids

13.1 Unless otherwise indicated in the BDS, alternative bids shall not be considered.

13.2 When alternative times for completion are explicitly invited, a statement to that effect will be included in the BDS, as will the method of evaluating different times for completion.

13.3 When specified in the BDS pursuant to ITB 13.1, and subject to ITB 13.4 below, Bidders wishing to offer technical alternatives to the requirements of the Bidding Document must first price the Employer’s design as described in the Bidding Document and shall further provide
all information necessary for a complete evaluation of the alternative by the Employer, including drawings, design calculations, technical specifications, breakdown of prices, and proposed construction methodology and other relevant details. Only the technical alternatives, if any, of the lowest evaluated Bidder conforming to the basic technical requirements shall be considered by the Employer.

13.4 When specified in the BDS, Bidders are permitted to submit alternative technical solutions for specified parts of the Works. Such parts will be identified in the BDS and described in Section 6 (Employer’s Requirements). The method for their evaluation will be stipulated in Section 3 (Evaluation and Qualification Criteria).

14. **Bid Prices and Discounts**

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

14.2 The Bidder shall submit a bid for the whole of the works described in ITB 1.1 by filling in prices for all items of the Works, as identified in Section 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.

14.3 The price to be quoted in the Letter of Price Bid shall be the total price of the Bid, excluding any discounts offered.

14.4 Unconditional discounts, if any, and the methodology for their application shall be quoted in the Letter of Price Bid, in accordance with ITB 12.1.

14.5 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 Table(s) of Adjustment Data in Section 4 (Bidding Forms) and the Employer may require the Bidder to justify its proposed indices and weightings.

14.6 If so indicated in ITB 1.1, bids are being 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.

14.7 All duties, taxes, and other levies payable by the Contractor under the Contract, or for any other cause, as of the date 28 days prior to the deadline for submission of bids, shall be included in the rates and prices and the total Bid Price submitted by the Bidder.
15. **Currencies of Bid and Payment**

15.1 The currency (ies) of the bid and payment shall be as specified in the BDS.

15.2 Bidders may be required by the Employer to justify, to the Employer's satisfaction, their local and foreign currency requirements, and to substantiate that the amounts included in the prices shown in the appropriate form(s) of Section 4, in which case a detailed breakdown of the foreign currency requirements shall be provided by Bidders.

16. **Documents Comprising the Technical Proposal**

16.1 The Bidder shall furnish a Technical Proposal 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.

17. **Documents Establishing the Qualifications of the Bidder**

17.1 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).

17.2 Domestic Bidders, individually or in joint ventures, applying for eligibility for domestic preference shall supply all information required to satisfy the criteria for eligibility in accordance with ITB 35.

18. **Period of Validity of Bids**

18.1 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 nonresponsive.

18.2 In exceptional circumstances, prior to the expiration of the bid validity period, the Employer may request Bidders to extend the period of validity of their Bids. The request and the responses shall be made in writing. If a bid security is requested in accordance with ITB 19, it shall also be extended twenty-eight (28) days beyond the deadline of the extended validity period. A Bidder may refuse the request without forfeiting its bid security. A Bidder granting the request shall not be required or permitted to modify its Bid.

19. **Bid Security/Bid Securing Declaration**

19.1 Unless otherwise specified in the BDS, the Bidder shall furnish as part of its bid, in original form, either a Bid Securing Declaration or a bid security as specified in the BDS. In the case of a bid security, the amount shall be as specified in the BDS.

19.2 A Bid Securing Declaration shall use the form included in Section 4 (Bidding Forms). The Employer will declare a Bidder ineligible to be awarded a Contract for a specified period of time, as indicated in the BDS, if the Bid Securing Declaration is executed.

19.3 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) a Fixed Deposit Receipt

all from a reputable bank from an eligible country as described in Section 5 (Eligible Countries). 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) or another form acceptable to the Employer. 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.

19.4 Any bid not accompanied by a substantially compliant bid security 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.

19.5 If a bid security is specified pursuant to ITB 19.1, the bid security of unsuccessful Bidders shall be returned as promptly as possible upon the successful Bidder’s furnishing of the performance security pursuant to ITB 42.

19.6 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.

19.7 The bid security may be forfeited or the Bid Securing Declaration executed:

(a) if a Bidder withdraws its bid during the period of bid validity specified by the Bidder on the Letters of Technical Bid and Price Bid, except as provided in ITB 18.2 or

(b) if the successful Bidder fails to:

(i) sign the Contract in accordance with ITB 41;

(ii) furnish a performance security in accordance with ITB 42; or

(iii) accept arithmetical corrections in accordance with ITB 33; or

(iv) furnish a domestic preference security, if applicable, in accordance with ITB 42.

19.8 The Bid Security or the Bid Securing Declaration of a JV shall be in the name of the JV that submits the Bid. If the JV has not been legally constituted at the time of bidding, the 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.

20. Format and Signing of Bid

20.1 The Bidder shall prepare one original of the Technical Bid and one original of the Price Bid comprising the Bid as described in ITB 11 and clearly mark it “ORIGINAL - TECHNICAL BID” and “ORIGINAL - PRICE BID”. Alternative bids, if permitted in accordance with ITB 13, shall be clearly marked “ALTERNATIVE”. 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.

20.2 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. All pages of the Bid, except for unamended printed literature, shall be signed or initialed by the person signing the bid.

20.3 Any amendments such as interlineations, erasures, or overwriting shall be valid only if they are signed or initialed by the person signing the bid.

D. Submission and Opening of Bids

21. Sealing and Marking of Bids

21.1 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) Bidders submitting bids by mail or by hand 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. If permitted in accordance with ITB 13, alternative bids shall be similarly sealed, marked and included in the sets. The rest of the procedure shall be in accordance with ITB 21.2 and 21.3.

(b) Bidders submitting bids electronically shall follow the electronic bid submission procedures specified in the BDS.

21.2 The inner and outer envelopes shall:

(a) bear the name and address of the Bidder;

(b) be addressed to the Employer as provided in BDS 22.1; and

(c) bear the specific identification of this bidding process indicated in the BDS 1.1.

21.3 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.

21.4 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 25.7.

21.5 If all envelopes are not sealed and marked as required, the Employer will assume no responsibility for the misplacement or premature opening of the bid.
22. Deadline for Submission of Bids

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

22.2 The Employer may, at its discretion, extend the deadline for the submission of bids by amending the Bidding Document in accordance with ITB 8, in which case all rights and obligations of the Employer and Bidders previously subject to the deadline shall thereafter be subject to the deadline as extended.

23. Late Bids

23.1 The Employer shall not consider any bid that arrives after the deadline for submission of bids, in accordance with ITB 22. Any bid received by the Employer after the deadline for submission of bids shall be declared late, rejected, and returned unopened to the Bidder.

24. Withdrawal, Substitution, and Modification of Bids

24.1 A Bidder may withdraw, substitute, or modify its Bid – 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.

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

24.3 No bid may be withdrawn, substituted, or modified in the interval between the deadline for submission of bids and the expiration of the period of bid validity specified by the Bidder on the Letters of Technical Bid and Price Bid or any extension thereof.

25. Bid Opening

25.1 The Employer shall open the Technical Bids in public at the address, date and time specified in the BDS in the presence of Bidders’ designated representatives and anyone who choose 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 custody of the Employer until the specified time of their opening. If the Technical Bid and Price Bid are submitted together in one envelope, the Employer may reject the entire Bid. Alternatively, the Price Bid may be immediately resealed for later evaluation.

25.2 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.
25.3 Second, outer envelopes marked “SUBSTITUTION” shall be opened. The inner envelopes containing the Substitution Technical Bid and/or Substitution Price Bid 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.

25.4 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 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, are 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.

25.5 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 or a bid securing declaration, 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. Unless otherwise specified in the BDS, all pages of the Letter of Technical Bid are to be initialed by at least three representatives of the Employer attending the bid opening. No Bid shall be rejected at the opening of Technical Bids except for late bids, in accordance with ITB Sub-Clause 23.1.

   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 a withdrawal, substitution, or modification; alternative proposals; and the presence or absence of a bid security or a bid securing declaration, 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.

25.6 At the end of the evaluation of the Technical Bids, the Employer will invite 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 for the opening of Price Bids.
25.8 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.

25.9 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.

25.10 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 alternative offers; 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. Unless otherwise specified in the BDS, all pages of the Letter of Price Bid and Schedules are to be initialed by at least three representatives of the Employer attending the bid opening. No Bid shall be rejected at the opening of Price Bids.

25.11 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.

E. Evaluation and Comparison of Bids

26. Confidentiality

26.1 Information relating to the examination, evaluation, comparison, and postqualification 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.

26.2 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.

26.3 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.

27. Clarification of Bids

27.1 To assist in the examination, evaluation, and comparison of the Technical and Price Bids, 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 the substance of the Technical Bid or prices in the Price Bid shall be sought, offered, or permitted, except to confirm the correction of arithmetic errors discovered by the Employer in the evaluation of the Price Bids, in accordance with ITB 33.

27.2 If a Bidder does not provide clarifications of its Bid by the date and time set in the Employer's request for clarification, its bid may be rejected.

28. Deviations, Reservations, and Omissions

28.1 During the evaluation of bids, the following definitions apply:
(a) “Deviation” is a departure from the requirements specified in the Bidding Document;
(b) “Reservation” is the setting of limiting conditions or withholding from complete acceptance of the requirements specified in the Bidding Document; and
(c) “Omission” is the failure to submit part or all of the information or documentation required in the Bidding Document.

29. Preliminary Examination of Technical Bids

29.1 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.

29.2 The Employer shall confirm that the following documents and information have been provided in the Technical Bid. If any of these documents or information is missing, the offer shall be rejected.
(a) Letter of Technical Bid;
(b) written confirmation of authorization to commit the Bidder;
(c) Bid Security or Bid Securing Declaration, if applicable; and
(d) Technical Proposal in accordance with ITB 16.

30. Responsiveness of Technical Bid

30.1 The Employer’s determination of a Bid’s responsiveness is to be based on the contents of the bid itself, as defined in ITB 11.

30.2 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.

30.3 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 (Employer’s Requirements) have been met without any material deviation or reservation.

30.4 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.

31. **Nonconformities, Errors, and Omissions**

31.1 Provided that a bid is substantially responsive, the Employer may waive any nonconformities in the Bid that do not constitute a material deviation, reservation or omission.

31.2 Provided that a Technical Bids 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 Bid. Failure of the Bidder to comply with the request may result in the rejection of its Bid.

31.3 Provided that a Technical Bids substantially responsive, the Employer shall rectify quantifiable nonmaterial nonconformities related to the Bid Price. To this effect, the Bid Price shall 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 method indicated in Section 3 (Evaluation and Qualification Criteria).

32. **Qualification of the Bidder**

32.1 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).

32.2 The determination shall be based upon an examination of the documentary evidence of the Bidder’s qualifications submitted by the Bidder, pursuant to ITB 17.1.

32.3 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.

33. **Correction of Arithmetical Errors**

33.1 During the evaluation of Price Bids, the Employer shall correct arithmetical errors on the following basis:

   (a) only for unit price contracts, if there is a discrepancy between the unit price and the total price that is obtained by multiplying the unit price and quantity, the unit price shall prevail and the total price shall be corrected, unless in the opinion of the Employer there is an obvious misplacement of the decimal point in the unit price, in which case the total price as quoted shall govern and the unit price shall be corrected;

   (b) if there is an error in a total corresponding to the addition or subtraction of subtotals, the subtotals shall prevail and the total shall be corrected;

   (c) if there is a discrepancy between the bid price in the Summary of
Bill of Quantities and the bid amount in item (c) of the Letter of Price Bid, the bid price in the Summary of Bill of Quantities will prevail and the bid amount in item (c) of the Letter of Price Bid will be corrected; and

(d) 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), (b) and (c) above.

33.2 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 or its bid securing declaration executed.

34. Conversion to Single Currency

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

35. Margin of Preference

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

36. Evaluation of Price 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 the Price Bid, the Employer shall consider the following:

(a) 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;

(b) price adjustment for correction of arithmetic errors in accordance with ITB 33.1;

(c) price adjustment due to discounts offered in accordance with ITB 14.4;

(d) converting the amount resulting from applying (a) to (c) above, if relevant, to a single currency in accordance with ITB 34;

(e) adjustment for nonconformities in accordance with ITB 31.3;

(f) application of all the evaluation factors indicated in 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 Price Bid, is specified in Section 3 (Evaluation and Qualification Criteria).
36.5 If the Bid for an admeasures 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 of the Bill of Quantities, to demonstrate the internal consistency of those prices with the construction methods and schedule proposed. After evaluation of the price analyses, 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 36.2.

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.

F. Award of Contract

39. Award Criteria

39.1 The Employer shall award the Contract to the Bidder whose offer has been determined to be the lowest evaluated bid and 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.

40.2 At the same time, the Employer shall also notify all other Bidders of the results of the bidding. The Employer will publish in an English language newspaper or well-known freely accessible website the results identifying the bid and lot numbers and the following information: (i) name of each Bidder who submitted a Bid; (ii) bid prices as read out at bid opening; (iii) name and evaluated prices of each Bid that was evaluated; (iv) name of bidders whose bids were rejected and the reasons for their rejection; and (v) name of the winning Bidder, and the price it offered, as well as the duration and summary scope of the contract awarded. After publication of the award, unsuccessful bidders may request in writing to the Employer for a debriefing seeking explanations on the grounds on which their bids were not selected. The Employer shall promptly respond in writing to any unsuccessful Bidder who, after Publication of contract award, requests a debriefing.

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

41. Signing of Contract

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

41.2 Within twenty-eight (28) 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 twenty-eight (28) 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 36.5, using for that purpose the Performance Security Form included in Section 9 (Contract Forms), or another form acceptable to the Employer.

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 or execution of the bid securing declaration. 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 also apply to the furnishing of a domestic preference security if so required.
## Section 2 - Bid Data Sheet

### A. General

<table>
<thead>
<tr>
<th>ITB 1.1</th>
<th>The number of the Invitation for Bids is: <strong>IDIPT (UK)/T3/NCB/W/07/R1/2014-15</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>ITB 1.1</td>
<td>The Employer is: <strong>Department of Tourism Government of Uttarakhand.</strong></td>
</tr>
</tbody>
</table>
| ITB 1.1 | The name of the NCB is: **Development of Tourism Infrastructure in Kartikeya Swami Circuit - Kartikeya Swami Temple.**  
The identification number of the NCB is: **One**  
The number and identification of lots comprising this NCB is: **One** |
| ITB 2.1 | The Borrower is: **India** |
| ITB 2.1 | The name of the Project is: **Infrastructure Development Investment Program for Tourism, Uttarakhand (Project 3).** |

### B. Contents of Bidding Documents

| ITB 7.1 | For **clarification purposes** only, the Employer's address is:  
Attention: **The Program Director,**  
Program Management Unit (PMU),  
Uttarakhand Tourism Development Board, Dehradun  
Street Address- Pandit Deendyal Upadhaya Paryatan Bhawan, Near ONGC Helipad, Garhi Cantonment, Dehradun  
Floor/Room no. : First Floor, Conference Room  
City: Dehradun  
Zip Code: 248003  
Tel:-91-135-2559900/25599872559898  
Facsimile number:-91-135-2559988  
Electronic mail address:utdb.pmu@gmail.com  
Requests for clarification should be received by the Employer no later than: 7 days before bid submission deadline (between 10:00 AM to 5:00 PM on working days). |
|---------|-----------------------------------------------------------------------------------|
| ITB 7.4 | A Pre-Bid meeting will take place on: **15th January 2016, at 15:00 hrs.** (In case this date is declared holiday then this event shall take place on next working day)  
at the: Office of The Program Director, Program Management Unit (PMU),  
Uttarakhand Tourism Development Board, Pandit Deendyal Upadhaya Paryatan Bhawan, Garhi Cantonment, Dehradun |
A site visit will be organized by the Employer on 14th January 2016, at 10:00 hrs, but no reimbursement will be made to the prospective bidders. The bidders should visit the site and observe ground conditions, borrow areas and quarries etc., and satisfy themselves about the suitability and sufficiency of availability of the construction materials.

C. Preparation of Bids

<table>
<thead>
<tr>
<th>ITB 10.1</th>
<th>The language of the bid is: <strong>English</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>ITB 11.2 (g)</td>
<td>The Bidder shall submit with its Technical Bid the following additional documents:</td>
</tr>
<tr>
<td>a)</td>
<td>Certified copies of Registration/Incorporation Certificate of Bidder and its JV partners, if any;</td>
</tr>
<tr>
<td>b)</td>
<td>A valid JV <strong>Agreement legally notarized or attested</strong> by an appropriate authority in the bidders’ home country, or a formal <strong>Letter of Intent</strong> to enter into a JV Agreement if applicable, specifying the financial stakes of each of the joint venture partners.</td>
</tr>
<tr>
<td>c)</td>
<td>Certified copies of Memorandum and Articles of Association of Bidder and its JV partners, if any;</td>
</tr>
<tr>
<td>d)</td>
<td>Certified copies of Audited Balance Sheets/Financial Statements for last three financial years for Bidder and its JV partners, if any;</td>
</tr>
<tr>
<td>e)</td>
<td>Certified copies of PAN and latest ITR for Bidder and its JV partners, if any;</td>
</tr>
<tr>
<td>f)</td>
<td>Power of Attorney in favor authorized signatory</td>
</tr>
<tr>
<td>g)</td>
<td>Approach &amp; Methodology for execution of Work</td>
</tr>
<tr>
<td>h)</td>
<td>Proposed Supervisory Personnel with their CVs</td>
</tr>
<tr>
<td>i)</td>
<td>Activity Schedules in Bar Chart</td>
</tr>
<tr>
<td>j)</td>
<td>Work Plan</td>
</tr>
<tr>
<td>k)</td>
<td>Organization Set up</td>
</tr>
<tr>
<td>l)</td>
<td>Name of Sub-Contractor, if any and his Letter of Association and Authorization.</td>
</tr>
<tr>
<td>ITB 11.3 (d)</td>
<td>The Bidder shall submit with its Price Bid the following additional documents: <strong>Nil.</strong></td>
</tr>
<tr>
<td>ITB 13.1</td>
<td>Alternative bids <strong>shall not</strong> be permitted.</td>
</tr>
<tr>
<td>ITB 13.2</td>
<td>Alternative times for completion <strong>shall not</strong> be permitted.</td>
</tr>
<tr>
<td>ITB 13.4</td>
<td>Alternative technical solutions shall be permitted for the following parts of the Works: <strong>Not Permitted.</strong></td>
</tr>
<tr>
<td>ITB 14.5</td>
<td>The prices quoted by the Bidder <strong>shall be</strong> subject to adjustment during the performance of the Contract.</td>
</tr>
<tr>
<td><strong>ITB 15.1</strong></td>
<td>The unit rates prices shall be quoted by the bidder entirely in: <strong>Indian Rupees (INR) only.</strong></td>
</tr>
<tr>
<td><strong>ITB 15.4</strong></td>
<td>The rate of exchange shall be the selling rates 28 days prior to the deadline for submission of bids published by: <strong>NOT APPLICABLE.</strong></td>
</tr>
<tr>
<td><strong>ITB 18.1</strong></td>
<td>The bid validity period shall be <strong>120 (one hundred and twenty) days.</strong></td>
</tr>
<tr>
<td><strong>ITB 19.1</strong></td>
<td>The Bidder shall furnish a bid security amounting to <strong>INR 0.70 Million.</strong> If it is in the form of <strong>Fixed Deposit Receipt (FDR),</strong> then the FDR must be pledged in the name of “Program Director, IDIPT – UK” payable at Dehradun.</td>
</tr>
<tr>
<td><strong>ITB 20.1</strong></td>
<td>In addition to the original of the bid, the number of copies is: <strong>Two</strong></td>
</tr>
</tbody>
</table>

**D. Submission and Opening of Bids**

| **ITB 21.1** | Bidders **shall not** have the option of submitting their bids electronically. |
| **ITB 21.1 (b)** | Not Applicable |
| **ITB 22.1** | For **bid submission purposes** only, the Employer’s address is:  
Attention: **The Program Director,** Program Management Unit (PMU), Uttarakhand Tourism Development Board, Dehradun, Pandit Deendyal Upadhaya Paryatan Bhawan, Near ONGC Helipad, Garhi Cantonment, Dehradun-248003  
**Tel:-91-135-2559900/25599872559898**  
**Facsimile number:-91-135-2559988**  
Electronic mail address:utdb.pmu@gmail.com  
The deadline for bid submission is:  
**Date: 28th January 2016,**  
**Time: 15:00 Hours** |
| **ITB 25.1** | The opening of the Technical Bid shall take place on **28th January 2016,** in the office of : **The Program Director,**  
Program Management Unit (PMU), Uttarakhand Tourism Development Board, Dehradun, Pandit Deendyal Upadhaya Paryatan Bhawan, Near ONGC Helipad, Garhi Cantonment, Dehradun-248003  
**Tel:-91-135-2559900/25599872559898**  
**Facsimile number:-91-135-2559988**  
Electronic mail address : utdb.pmu@gmail.com  
Time :Immediately after the bid deadline (**15:30 Hours**)  
If electronic bid submission is permitted in accordance to 21.1,the specific bid opening procedure shall be: **Not Applicable** |
### E. Evaluation and Comparison of Bids

| 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: **Not Applicable**  
| | The source of the selling exchange rate shall be: **Not Applicable**  
| | The date for the selling exchange rate shall be: **Not applicable.**  
| ITB 35.1 | A margin of preference **shall not** apply to this contract. |
### Section 3 - Evaluation and Qualification Criteria
- Post Qualification -

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<td>1.3 Completion Time</td>
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<td>1.4 Technical Alternatives</td>
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<td>2.1.3 ADB Eligibility</td>
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<td>2.1.5 United Nations Eligibility</td>
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</tr>
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<th>3-5</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.2.1 Pending Litigation and Arbitration</td>
<td>3-5</td>
</tr>
</tbody>
</table>

<table>
<thead>
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<td>2.3.2 Average Annual Construction Turnover</td>
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<tr>
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</tr>
</tbody>
</table>

<table>
<thead>
<tr>
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<th>3-8</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.4.1 Contracts of Similar Size and Nature</td>
<td>3-8</td>
</tr>
<tr>
<td>2.4.2 Construction Experience in Key Activities</td>
<td>3-9</td>
</tr>
</tbody>
</table>
1. Evaluation

In addition to the criteria listed in ITB 36.2 (a) – (e) the following criteria shall apply:

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 (Employer's Requirements).

Non-compliance with equipment and personnel requirements described in Section 6 (Employer’s Requirements) shall not normally be a ground for bid rejection and such non-compliance will be subject to clarification during bid evaluation and rectification prior to contract award.

1.2 Multiple Contracts: Not applicable

1.3 Completion Time:

An alternative Completion Time, if permitted under ITB 13.2, will be evaluated as follows: Not Applicable.

1.4 Technical Alternatives

Technical alternatives, if permitted under ITB 13.4, will be evaluated as follows: Not Applicable.

1.5 Quantifiable Nonconformities, Errors and Omissions

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

Pursuant to ITB 31.3, the cost of all quantifiable nonmaterial nonconformities or omissions shall be evaluated. The Employer will make its own assessment of the cost of any nonmaterial nonconformities and omissions for the purpose of ensuring fair comparison of bids.

1.6 Domestic Preference:

If a margin of preference shall apply under ITB 35.1, the procedure will be as follows as: Not Applicable.
2. Qualification

Unless specifically indicated otherwise, it is the legal entity or entities comprising the Bidder, and not the Bidder’s parent companies, subsidiaries or affiliates, that must satisfy the qualification criteria described below.

2.1 Eligibility

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Compliance Requirements</th>
<th>Documents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Requirement</td>
<td>Single Entity</td>
<td>Joint Venture</td>
</tr>
<tr>
<td>Requirement</td>
<td>All Partners Combined</td>
<td>Each Partner</td>
</tr>
</tbody>
</table>

2.1.1 Nationality

Nationality in accordance with ITB Sub-Clause 4.2.

- must meet requirement
- must meet requirement
- must meet requirement
- not applicable

Forms ELI - 1; ELI - 2 with attachments

2.1.2 Conflict of Interest

No conflicts of interest in accordance with ITB Sub-Clause 4.3.

- must meet requirement
- must meet requirement
- must meet requirement
- not applicable

Letter of Technical Bid

2.1.3 ADB Eligibility

Not having been declared ineligible by ADB, as described in ITB Sub-Clause 4.4.

- must meet requirement
- must meet requirement
- must meet requirement
- not applicable

Letter of Technical Bid

2.1.4 Government-Owned Entity

Bidder required to meet conditions of ITB Sub-Clause 4.5.

- must meet requirement
- must meet requirement
- must meet requirement
- not applicable

Forms ELI - 1; ELI - 2 with attachments

2.1.5 United Nations Eligibility

Not having been excluded by an act of compliance with a UN Security Council resolution or Employer’s country law, as described in ITB Sub-Clause 4.7.

- must meet requirement
- must meet requirement
- must meet requirement
- not applicable

Letter of Technical Bid
2.2 Pending Litigation

Pending Litigation criterion **shall** apply.

2.2.1 Pending Litigation and Arbitration

<table>
<thead>
<tr>
<th>Criteria Requirement</th>
<th>Compliance Requirements</th>
<th>Documents</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Single Entity</td>
<td>Joint Venture</td>
</tr>
<tr>
<td></td>
<td></td>
<td>All Partners Combined</td>
</tr>
<tr>
<td>All pending litigation and arbitration, if any, shall be treated as resolved against the Bidder and so shall in total not represent more than (50%) <strong>fifty percent</strong> of the Bidder’s net worth calculated as the difference between total assets and total liabilities should be positive.</td>
<td>must meet requirement by itself or as partner to past or existing JV</td>
<td>not applicable</td>
</tr>
</tbody>
</table>
### 2.3 Financial Requirements

#### 2.3.1 Historical Financial Performance

 Submission of audited financial statements or, if not required by the law of the Bidder’s country, other financial statements acceptable to the Employer, for the last three (3) financial years to demonstrate the current soundness of the Bidders financial position. As a minimum, the Bidder’s net worth for the last year, calculated as the difference between total assets and total liabilities should be positive.

<table>
<thead>
<tr>
<th>Criteria Requirement</th>
<th>Compliance Requirements</th>
<th>Documents</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Single Entity</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Joint Venture</td>
<td></td>
</tr>
<tr>
<td></td>
<td>All Partners Combined</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Each Partner</td>
<td></td>
</tr>
<tr>
<td></td>
<td>One Partner</td>
<td></td>
</tr>
<tr>
<td>Submission of audited financial statements or, if not required by the law of the Bidder’s country, other financial statements acceptable to the Employer, for the last three (3) financial years to demonstrate the current soundness of the Bidders financial position. As a minimum, the Bidder’s net worth for the last year, calculated as the difference between total assets and total liabilities should be positive.</td>
<td>must meet requirement</td>
<td>not applicable</td>
</tr>
</tbody>
</table>
### 2.3.2 Average Annual Construction Turnover

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Compliance Requirements</th>
<th>Documents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum average annual construction turnover of <strong>INR. 17.31 Million</strong></td>
<td></td>
<td>Form FIN - 2</td>
</tr>
<tr>
<td>calculated as total certified payments received for contracts in progress or completed, within the last <strong>three (3) years.</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Single Entity</th>
<th>Joint Venture</th>
<th>Submission Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>All Partners Combined</td>
<td>Each Partner</td>
</tr>
<tr>
<td>must meet requirement</td>
<td></td>
<td>must meet requirement</td>
<td>must meet Twenty five (25%) percent of the requirement</td>
</tr>
</tbody>
</table>
### 2.3.3 Financial Resources Requirement

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Compliance Requirements</th>
<th>Documents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Requirement</td>
<td>Single Entity</td>
<td>Joint Venture</td>
</tr>
<tr>
<td></td>
<td></td>
<td>All Partners</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Combined</td>
</tr>
<tr>
<td>Using Forms FIN-3 and FIN-4 in Section 4 (Bidding Forms), the Bidder must demonstrate access to, or availability of, liquid assets¹, lines of credit, or other financial resources (other than any contractual advance payments) to meet the Bidder's financial resources requirement indicated in Form FIN-4.</td>
<td>must meet requirement</td>
<td>must meet requirement</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

¹ Liquid Assets mean cash and cash equivalents, short-term financial instruments, short-term available-for-sale-securities, marketable securities, trade receivables, short-term financing receivables and other assets that can be converted into cash within ONE YEAR.
2.4 **Construction Experience**

2.4.1 **Contracts of Similar Size and Nature**

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Compliance Requirements</th>
<th>Documents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Participation as a Contractor / Management Contractor or Sub Contractor in contracts of similar nature within the last <strong>Seven (7) years</strong> in at least one contract that has been successfully or substantially completed, where the value of the Bidder’s participation is not less than <strong>INR 17.31 Million</strong>.</td>
<td></td>
<td>Form EXP - 1</td>
</tr>
</tbody>
</table>

The similarity of the Bidder’s participation shall be based on the physical size, nature of works, complexity, methods, technology or other characteristics as described in Section 6 (Employer’s Requirements).
2.4.2 Construction Experience in Key Activities (May be complied by Specialist Subcontractors. Employer shall require evidence of subcontracting agreement from the Bidder. Specialist Subcontractor is a specialist enterprise engaged for highly specialized processes which cannot be provided by the main Contractor.)

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Compliance Requirements</th>
<th>Documents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Requirement</td>
<td>Single Entity</td>
<td>Joint Venture</td>
</tr>
<tr>
<td>For the above or other contracts executed during the period stipulated in 2.4.1 above, a minimum construction experience in the following key activities:</td>
<td>must meet requirements</td>
<td>must meet requirements</td>
</tr>
<tr>
<td>Building Construction OR CC Road/Pathway construction</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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Letter of Technical Bid

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

NCB No : IDIPT (UK)/T3/NCB/W/07/R1/2014-15

Invitation for Bid No : UK/IDIPT-III/ DDN/ 02

To: ............................................................................................................................................................

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: Development of Tourism Infrastructure in Kartikeya Swami Circuit- Kartikeya Swami Temple.

(c) Our Bid consisting of the Technical Bid and the Price Bid shall be valid for a period of 120 days 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) Our firm, including any subcontractors or suppliers for any part of the Contract, have nationalities from eligible countries in accordance with ITB 4.2.................................;

(e) We, including any subcontractors or suppliers for any part of the contract, do not have any conflict of interest in accordance with ITB 4.3;

(f) We are not participating, as a Bidder in more than one bid in this bidding process in accordance with ITB 4.3(e), other than alternative offers submitted in accordance with ITB 13;

(g) Our firm, its affiliates or subsidiaries, including any Subcontractors or Suppliers for any part of the contract, has not been declared ineligible by ADB, under the Employer’s country laws or official regulations or by an act of compliance with a decision of the United Nations Security Council;

(h) We are not a government owned entity / We are a government owned entity but meet the requirements of ITB4.5;

(i) We agree to permit ADB 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 ADB.
(j) If our Bid is accepted, we commit to mobilizing key equipment and personnel in accordance with the requirements set forth in Section 6 (Employer's Requirements) and our technical proposal, or as otherwise agreed with the Employer.

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

1 Use one of the two options as appropriate
Letter of Price Bid

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

NCB No: IDIPT (UK)/T3/NCB/W/07/R1/2014-15
Invitation for Bid No: UK/IDIPT-III/ DDN/ 02

To: ............................................................................................................................................................

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:

(c) The total price of our Bid, excluding any discounts offered in item (d) below is: Development of Tourism Infrastructure in Kartikeya Swami Circuit- Kartikeya Swami Temple.

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

(e) Our Bid shall be valid for a period of 120 days 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;

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

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

<table>
<thead>
<tr>
<th>Name of Recipient</th>
<th>Address</th>
<th>Reason</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>

(h) 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
(i) We understand that you are not bound to accept the lowest evaluated bid or any other bid that you may receive.

(j) We agree to permit ADB 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 ADB.

---

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

Personnel

Equipment

Site Organization

Method Statement

Mobilization Schedule

Construction Schedule
Technical Proposal - Personnel

**Form PER – 1: Proposed Personnel**
Bidder shall provide the details of the proposed personnel and their experience records in the relevant Information Forms below for each candidate:

<table>
<thead>
<tr>
<th></th>
<th>Title of position*</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td></td>
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<tr>
<td>2.</td>
<td></td>
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<tr>
<td>3.</td>
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<tr>
<td>4.</td>
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<tr>
<td>etc.</td>
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</tbody>
</table>

*As listed in Section 6 (Employer’s Requirements).
Form PER – 2: Resume of Proposed Personnel
The Bidder shall provide all the information requested below.

<table>
<thead>
<tr>
<th>Position</th>
<th>Personnel information</th>
<th>Date of birth</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Name</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Professional qualifications</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Present employment</th>
<th>Name of employer</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Address of employer</td>
</tr>
<tr>
<td></td>
<td>Telephone</td>
</tr>
<tr>
<td></td>
<td>Fax</td>
</tr>
<tr>
<td></td>
<td>Job title</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>From</th>
<th>To</th>
<th>Company / Project / Position / Relevant Technical and Management Experience</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td></td>
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</tbody>
</table>
Technical Proposal - Equipment

Form EQU: Equipment

The Bidder shall provide adequate information and details to demonstrate clearly that it has the capability to meet the equipment requirements indicated in Section 6 (Employer’s Requirements), using the Forms below. A separate Form shall be prepared for each item of equipment listed, or for alternative equipment proposed by the Bidder.

<table>
<thead>
<tr>
<th>Item of Equipment</th>
<th>Equipment Information</th>
<th>Current Status</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Name of manufacturer</td>
<td>Current location</td>
</tr>
<tr>
<td></td>
<td>Model and power rating</td>
<td>Details of current commitments</td>
</tr>
<tr>
<td></td>
<td>Capacity</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Year of manufacture</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Source</th>
<th>Indicate source of the equipment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>☐ Owned ☐ Rented ☐ Leased ☐ Specially manufactured</td>
</tr>
</tbody>
</table>

Omit the following information for equipment owned by the Bidder.

<table>
<thead>
<tr>
<th>Owner</th>
<th>Name of owner</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Address of owner</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Telephone</th>
<th>Contact name and title</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fax</td>
<td>Telex</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Agreements</th>
<th>Details of rental / lease / manufacture agreements specific to the project</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Site Organization
Method Statement
Mobilization Schedule
Construction Schedule
Bidders 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

<table>
<thead>
<tr>
<th>Bidder’s Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bidder’s legal name</td>
</tr>
<tr>
<td>In case of JV, legal name of each partner</td>
</tr>
<tr>
<td>Bidder’s country of constitution</td>
</tr>
<tr>
<td>Bidder’s year of constitution</td>
</tr>
<tr>
<td>Bidder’s legal address in country of constitution</td>
</tr>
<tr>
<td>Bidder’s authorized representative (name, address, telephone numbers, fax numbers, e-mail address)</td>
</tr>
</tbody>
</table>

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, letter of intent to form JV or 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.
Form ELI - 2: JV Information Sheet

Each member of a JV and Specialist Subcontractor must fill in this form

<table>
<thead>
<tr>
<th>JV / Specialist Subcontractor Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bidder's legal name</td>
</tr>
<tr>
<td>JV Partner's or Specialist Subcontractor's legal name</td>
</tr>
<tr>
<td>JV Partner's or Specialist Subcontractor's country of constitution</td>
</tr>
<tr>
<td>JV Partner's or Specialist Subcontractor's year of constitution</td>
</tr>
<tr>
<td>JV Partner's or Specialist Subcontractor's legal address in country of constitution</td>
</tr>
</tbody>
</table>

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.

Specialist Sub-contractor is a specialist Enterprise engaged for highly specialised processes which can not be provided by the main Contractor.
Form LIT – 1: Pending Litigation and Arbitration

Each Bidder or member of a JV must fill in this form if so required under Criterion 2.2 of Section 3(Evaluation and Qualification Criteria).

<table>
<thead>
<tr>
<th>Year</th>
<th>Matter in Dispute</th>
<th>Value of Pending Claim in INR Equivalent</th>
<th>Value of Pending Claim as a Percentage of Net Worth</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Form FIN - 1: Historical Financial Performance

Each Bidder or member of a JV must fill in this form

<table>
<thead>
<tr>
<th>Financial Data for Previous 3 Years [INR Equivalent]</th>
</tr>
</thead>
</table>

Information from Balance Sheet

<table>
<thead>
<tr>
<th>Total Assets</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Liabilities</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Net Worth</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Current Assets</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Current Liabilities</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Information from Income Statement

<table>
<thead>
<tr>
<th>Total Revenues</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Profits Before Taxes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Profits After Taxes</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Attached are copies of financial statements (balance sheets including all related notes, and income statements) for the last 3 (Three) years, as indicated above, complying with the following conditions.

- Unless otherwise required by Section 3 of the Bidding Document, all such documents reflect the financial situation of legal entity or entities comprising the Bidder and not the Bidder’s parent companies, subsidiaries or affiliates.
- Historic financial statements must be audited by a certified accountant.
- Historic financial statements must be complete, including all notes to the financial statements.
- Historic financial statements must correspond to accounting periods already completed and audited (no statements for partial periods shall be requested or accepted).
Form FIN - 2: Average Annual Construction Turnover

Each Bidder or member of a JV must fill in this form

The information supplied should be the Annual Turnover of the Bidder or each member of a JV in terms of the amounts billed to clients for each year for work in progress or completed, *(converted to US Dollars at the rate of exchange for ICB or INR for NCB contracts)* at the end of the period reported.

<table>
<thead>
<tr>
<th>Year</th>
<th>Amount Currency (INR)</th>
<th>Exchange Rate</th>
<th>INR</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>NA</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>NA</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>NA</td>
<td></td>
</tr>
</tbody>
</table>

Average Annual Construction Turnover

---

Bidding Document for IDIPT (UK)  
Contract Packages No: UK/IDIPT-III/ DDN/ 02
Form FIN – 3: Availability of Financial Resources

Specify proposed sources of financing, such as liquid assets\(^1\), lines of credit, and other financial resources (other than any contractual advance payments) available to meet the financial resources requirement indicated in Form Fin – 4.

<table>
<thead>
<tr>
<th>No.</th>
<th>Source of financing</th>
<th>Amount (INR)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\(^1\) Liquid Assets mean cash and cash equivalents, short-term financial instruments, short-term available-for-sale-securities, marketable securities, trade receivables, short-term financing receivables and other assets that can be converted into cash within one year.
Form FIN- 4: Financial Resources Requirement

Bidder (or each JV partner) should provide information indicated below in order to calculate the aggregated financial resources requirement, which equals the sum of: (i) the Bidder’s (or each JV partner’s) current commitments on all contracts that have been awarded, or for which a letter of intent or acceptance has been received, or for contracts approaching completion, but for which an unqualified, full completion certificate has yet to be issued and (ii) financial resources requirement for subject contract as determined by the Employer. Bidder must also disclose any other financial obligations that could materially affect the implementation of subject contract if such contract were to be awarded to the Bidder.

<table>
<thead>
<tr>
<th>No.</th>
<th>Name of Contract</th>
<th>Employer’s Contact (Address, Tel, Fax)</th>
<th>Contract Completion Date</th>
<th>Remaining Contract Period in months (A)</th>
<th>Outstanding Contract Value (B)</th>
<th>Monthly Financial Resources Requirement (B / A)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

A. Cumulative Financial Resources Requirement for Current Contract Commitments ³

B. Financial Resources Requirement for Subject Contract (Employer to specify)

Financial Resources Requirement (Sum of A and B)

1. Remaining contract period to be calculated from 28 days prior to bid submission deadline.

2. Remaining Outstanding Contract Values to be calculated from 28 days prior to the bid submission deadline (INR equivalent based on the foreign exchange rate as of the same date).

³ Bidder should calculate this amount based on the sum of Monthly Financial Resources Requirements for Each Current Works Contract based on the following calculation:

Estimated Contract Value (Inclusive of Taxes and Duties)  
Completion Period in Months
Form EXP – 1: Contracts of Similar Size and Nature

Fill up one (1) form per contract.

<table>
<thead>
<tr>
<th>Contract of Similar Size and Nature</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contract No. . . . . of . . . . .</td>
</tr>
<tr>
<td>Award Date</td>
</tr>
<tr>
<td>Total Contract Amount</td>
</tr>
<tr>
<td>If partner in a JV or subcontractor, specify participation of total contract amount</td>
</tr>
<tr>
<td>Employer’s Name</td>
</tr>
</tbody>
</table>

Description of the similarity in accordance with Criteria 2.4.1 of Section 3
Form EXP - 2: Construction Experience in Key Activities

Fill up one (1) form per contract

<table>
<thead>
<tr>
<th>Contract with Similar Key Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contract No. . . . . . of . . . . . . .</td>
</tr>
<tr>
<td>Award Date</td>
</tr>
<tr>
<td>Total Contract Amount</td>
</tr>
<tr>
<td>If partner in a JV or subcontractor, specify participation of total contract amount</td>
</tr>
<tr>
<td>Employer’s Name</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

Description of the key activities in accordance with Criteria 2.4.2 of Section 3

1. Building Construction

2. CC Road / pathway Construction
## Schedules

### Schedule of Payment Currencies

For .................................. Insert name of Section of the Works ..........................................................

Separate tables may be required if the various sections of the Works (or of the Bill of Quantities) will have substantially different foreign and local currency requirements. In such a case, the Employer should prepare separate tables for each Section of the Works.

<table>
<thead>
<tr>
<th>Name of Payment Currency</th>
<th>Amount of Currency</th>
<th>Rate of Exchange to Local Currency</th>
<th>Local Currency Equivalent $ C = A \times B $</th>
<th>Percentage of Net Bid Price (NBP) $ \frac{100 \times C}{NBP} $</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local currency</td>
<td></td>
<td>1.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Foreign Currency #1</td>
<td>NOT Applicable</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Foreign Currency #2</td>
<td>NOT Applicable</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Foreign Currency #</td>
<td>NOT Applicable</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Net Bid Price</td>
<td></td>
<td></td>
<td></td>
<td>100.00</td>
</tr>
<tr>
<td>Provisional Sums</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BID PRICE</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table(s) of Adjustment Data:

Table A - Local Currency

<table>
<thead>
<tr>
<th>Index Code</th>
<th>Index Description</th>
<th>Source of Index</th>
<th>Base Value and Date</th>
<th>Bidder's Local Currency Amount</th>
<th>Bidder's Proposed Weighting (coefficient)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Nonadjustable</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>a: (by Employer) b: c: d: e:</td>
</tr>
</tbody>
</table>

Total 1.00

Table B - Foreign Currency: NOT APPLICABLE

Name of Currency: .................................................................

If the Bidder wishes to quote in more than one foreign currency, but in no case more than three, this table should be repeated for each foreign currency.

<table>
<thead>
<tr>
<th>Index Code</th>
<th>Index Description</th>
<th>Source of Index</th>
<th>Base Value and Date</th>
<th>Bidder's Currency in Type/Amount</th>
<th>Equivalent in FC1</th>
<th>Bidder's Proposed Weighting (coefficient)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Nonadjustable</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>a: (by Employer) b: c: d: e:</td>
</tr>
</tbody>
</table>

Total 1.00
# Section 5 - Eligible Countries

This section contains the list of eligible countries.

<table>
<thead>
<tr>
<th></th>
<th>Country</th>
<th></th>
<th>Country</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>AFG Afghanistan</td>
<td>35</td>
<td>FSM Micronesia, Federal States of America</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>ARM Armenia</td>
<td>36</td>
<td>MON Mongolia</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>AUS Australia</td>
<td>37</td>
<td>MYA Myanmar</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>AUT Austria</td>
<td>38</td>
<td>NAM Nauru, Republic of</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>AZE Azerbaijan</td>
<td>39</td>
<td>NEP Nepal</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>BAN Bangladesh</td>
<td>40</td>
<td>NET Netherlands</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>BEL Belgium</td>
<td>41</td>
<td>NZL New Zealand</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>BHU Bhutan</td>
<td>42</td>
<td>NOR Norway</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>BRU Brunei Darussalam</td>
<td>43</td>
<td>PAK Pakistan</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>CAM Cambodia</td>
<td>44</td>
<td>PAL Palau</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>CAN Canada</td>
<td>45</td>
<td>PNG Papua New Guinea</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>PRC People's Republic of China</td>
<td>46</td>
<td>PHI Philippines</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>COC Cook Islands</td>
<td>47</td>
<td>POR Portugal</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>DEN Denmark</td>
<td>48</td>
<td>SAM Samoa</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>FJI Fiji Islands, Republic of</td>
<td>49</td>
<td>SGN Singapore</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>FIN Finland</td>
<td>50</td>
<td>SOL Solomon Islands</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>FRA France</td>
<td>51</td>
<td>SPA Spain</td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>GEO Georgia</td>
<td>52</td>
<td>SRI Sri Lanka</td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>GER Germany</td>
<td>53</td>
<td>SWE Sweden</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>HKG Hong Kong, China</td>
<td>54</td>
<td>SWI Switzerland</td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>IND India</td>
<td>55</td>
<td>TAJ Tajikistan</td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>INO Indonesia</td>
<td>56</td>
<td>TAI Taipei, China</td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>IRE Ireland</td>
<td>57</td>
<td>THA Thailand</td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>ITA Italy</td>
<td>58</td>
<td>TMI Timor-Leste, Democratic Republic of Timor-Leste, Democratic Republic of Timor-Leste, Democratic Republic of</td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>JPN Japan</td>
<td>59</td>
<td>TUN Tonga</td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>KAZ Kazakhstan</td>
<td>60</td>
<td>TUR Turkey</td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>KIR Kiribati</td>
<td>61</td>
<td>TKM Turkmenistan</td>
<td></td>
</tr>
<tr>
<td>28</td>
<td>KOR Korea</td>
<td>62</td>
<td>TUV Tuvalu</td>
<td></td>
</tr>
<tr>
<td>29</td>
<td>KGZ Kyrgyz</td>
<td>63</td>
<td>UKR United Kingdom</td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>LAO Laos Democratic Republic</td>
<td>64</td>
<td>USA United States of America</td>
<td></td>
</tr>
<tr>
<td>31</td>
<td>LUX Luxembourg</td>
<td>65</td>
<td>UZB Uzbekistan</td>
<td></td>
</tr>
<tr>
<td>32</td>
<td>MAL Malaysia</td>
<td>66</td>
<td>VAN Vanuatu</td>
<td></td>
</tr>
<tr>
<td>33</td>
<td>MLD Maldives</td>
<td>67</td>
<td>VIE Viet Nam</td>
<td></td>
</tr>
</tbody>
</table>
# Section 6 –Employer’s Requirements

## Table of Contents

- Specifications ................................................................................................................... 6-2
- Supplementary Information Regarding Works To Be Procured ................................. 6-312
- Drawings ...................................................................................................................... 6-313
- Personnel Requirements .............................................................................................. 6-353
- Equipment Requirements ............................................................................................. 6-354
Specifications

6.1 Scope of Works for Kartikey swami Temple:

The scope of works in the contract package includes the following:

- **a)** Development of a pedestrian route or pathway from Main road to temple. Proposed pedestrian pathway total length is 1200 mtr.
- **b)** Development of Camping site, sitting arrangement, Rest Shelter, Informative Display & Publicity work, Viewing Deck, Entrance gate, Railing in Temple premises, Pathway covering shelter, Renovation of existing toilet, Hill view pointer model etc.
- **c)** Providing Solar lighting arrangement on the proposed pedestrian pathway & Temple Premises.
- **d)** Renovation work of Kartikeyswami temple & Vyas Gufa.
- **e)** Construction of Retaining wall length is approx 200 mtr & Breast wall length is approx 120 mtr along the pathway.
- **f)** Renovation work of Existing dharamshala.
- **g)** Improvement of existing lodging facility with furniture.
- **h)** Construction of (3 Nos) Pre-Fabricated toilet block.
- **i)** Providing fire fighting work.

6.2 Technical Specification:

Technical specifications of the major components of the contract package are mentioned below.

6.2.1 Pedestrian Pathway from Main Road to Kartikey swami Temple.

A pedestrian pathway is proposed which starts from main road to temple and pedestrian pathway length is approx 1200 meter. Technical specification of the pathway is given below.

<table>
<thead>
<tr>
<th>Component</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length of Pedestrian Pathway</td>
<td>Approx 1200 Meter</td>
</tr>
<tr>
<td>Width of Pedestrian Pathway</td>
<td>Approx 1.70 Meter</td>
</tr>
<tr>
<td>Sub grade</td>
<td>Laying Dry Stone Kharanja/ Crushed Stone 10 cm thick</td>
</tr>
<tr>
<td>Sub base</td>
<td>Providing and laying in position cement concrete of specified grade 1:1.5:3</td>
</tr>
<tr>
<td></td>
<td>(1 Cement : 1.5 coarse sand 3 graded stone aggregate 20 mm nominal size),</td>
</tr>
<tr>
<td></td>
<td>25 mm thick.</td>
</tr>
<tr>
<td>Hard Stone</td>
<td>Providing and laying 10 to 15 cm thick hard stone on</td>
</tr>
</tbody>
</table>
### 6.2.2 Construction of Retaining wall & Breast Wall along the Pedestrian Pathway.

Retaining wall (length Approx 200 Mtr) and Breast wall (length Approx 120 Mtr) has been proposed along the approach road from main road for protection against sliding. RR masonry in 1:6 has been proposed for construction of walls.

#### 6.2.3 Pre-Fabricated Small Toilet Complex:

Pre-Fabricated Toilet (3 Nos) Complex will be constructed at the facility location along the pathway. The toilet complexes will have separate blocks for gents and ladies. Each block shall have Indian pattern water closets.

There shall be also an arrangement to direct supply of water to toilet via pipe line. Common Wash basins will be provided. Ventilators will be provided for good air circulation as per drawing and site requirements. Door shall be UPVC type as per IS specification. The toilet blocks height 3.46 mtr from the ground level. Lighting shall be for toilet block as per norms.

The toilets shall be of Pre-Fabricated structures with prefabricated walls, finished externally with suitable paints. The internal flooring shall be of Ceramic glazed floor tiles. Internal walls, susceptible to water splashes shall be protected with ceramic glazed wall tiles over suitable backing whereas the remaining surfaces shall be rendered with suitable paints. Technical specification of the toilet complexes are given below.

<table>
<thead>
<tr>
<th><strong>Section 6 - Works Requirements</strong></th>
<th><strong>Bidding Document for IDIPT (UK)</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Section 6 - Works Requirements</td>
<td>Contract Package No: UK/IDIPT-III/ DDN/ 02</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>25 mm layer of PCC (1:1.5:3) and Minimum size of stone 20 cm x 20 cm and stone joints filling by Grade PC 5:3)</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Kerb Channel Drain</strong></td>
</tr>
<tr>
<td>Kerb channel 30cm wide and 50mm thick of cement concrete 1:3:6 (1 cement:3 coarse sand:6 graded stone aggregate 20mm nominal size) over 75mm bed of dry brick ballast 40 mm nominal size well rammed and consolidated and grouted with fine sand including finishing the top smooth etc. complete.</td>
</tr>
<tr>
<td><strong>Kerb Stone</strong></td>
</tr>
<tr>
<td>Near ground level factory made kerb stone of M-25 grade cement in position to the required line, level and curvature jointed with cement mortar 1:3(1 cement: 3 coarse sand ) including making joints with or without grooves (thickness of joints except at sharp curve shall not to more than 5mm) including making drainage opening wherever required complete etc.</td>
</tr>
</tbody>
</table>
Numbers of facilities in Each Toilet Complex | For Men: Toilet 1, For Women: Toilet 1 and common wash basin in each toilet
---|---
Numbers of Septic Tank | 50 Users
Entrance | Separate entry for Ladies and Gents will be there as per drawing and specifications
Wall | Prefabricated Wall as per drawing and specifications
Wall Finishing | Ceramic Glazed Tiles as per drawing and specifications
Floor Finishing | Ceramic Glazed Tiles as per drawings and/or specifications
Wash Basin, water closet (Indian type W.C.) | China style from Hind ware/Parry ware
Plumbing | Plumbing work will be done with TATA – M, GI Pipe With GI fittings, traps. as per drawing and Specifications
Ventilation | Complex will be well ventilated as per drawing and Specifications
Electrical Works | Quality electrical wiring will be done as per drawing and specifications

6.2.4 Pre-Fabricated Big Toilet Complex:

Pre-Fabricated Toilet (1 Nos) Complex will be constructed at the facility location near existing dharamshala. The toilet complexes will have separate blocks for gents and ladies. Each block shall have European pattern water closets.

There shall be also an arrangement to direct supply of water to toilet via pipe line. Wash basins will be provided for each block. Ventilators will be provided for good air circulation as per drawing and site requirements. Door shall be UPVC type as per IS specification. The toilet block height 3.59 mtr from the ground level. Lighting shall be for toilet block as per norms.

The toilets shall be of Pre-Fabricated structures with prefabricated walls, finished externally with suitable paints. The internal flooring shall be of Ceramic glazed floor tiles. Internal walls, susceptible to water splashes shall be protected with ceramic glazed wall tiles over suitable backing whereas the remaining surfaces shall be rendered with suitable paints. Technical specification of the toilet complexes are given below.

| Numbers of facilities in Each Toilet Complex | For Men: Urinal 2, Toilet 2, Wash Basin 2 For Women: Toilet 2, Wash Basin 2 |

6.2.5 Sitting Arrangement:

50 Nos sitting bench has been proposed out of which few will be inside temple premises and rest along the pathway from the main road. The size of bench has been kept as 2.00m length and 0.6m width with the height of 0.45m from the ground level. Random Rubble masonry in cement mortar 1:6 has been taken up to 0.375m from above ground level and 0.30 m. below ground level and over PCC (1:3:6) of 0.10 m. There will be a coping of 0.075m. thick CC (1:2:4) over which 25 mm thick kota stone slab will be fixed.

6.2.6 Renovation of Existing Temple and Vyas Gufa.

Renovation of existing temple with stone cladding on existing wall and wooden cladding with Jhalar on existing column and beam. Existing floor tiles to be replaced with wooden planking.

6.2.7 Railing in Temple Premises

Railing proposed in temple complex. Railing constructed with RCC post and circular hollow section pipe. And in railing sitting bench also provided

6.2.8 Rest Shelter

<table>
<thead>
<tr>
<th>Numbers of Septic Tank</th>
<th>100 Users</th>
</tr>
</thead>
<tbody>
<tr>
<td>Entrance</td>
<td>Separate entry for Ladies and Gents will be there as per drawing and specifications</td>
</tr>
<tr>
<td>Wall</td>
<td>Prefabricated Wall as per drawing and specifications</td>
</tr>
<tr>
<td>Wall Finishing</td>
<td>Ceramic Glazed Tiles as per drawing and specifications</td>
</tr>
<tr>
<td>Floor Finishing</td>
<td>Ceramic Glazed Tiles as per drawings and / or specifications</td>
</tr>
<tr>
<td>Wash Basin, water closet (Indian type W.C.)</td>
<td>China style from Hind ware/Parry ware</td>
</tr>
<tr>
<td>Plumbing</td>
<td>Plumbing work will be done with TATA – M,GI Pipe With GI fittings, traps. as per drawing and Specifications</td>
</tr>
<tr>
<td>Ventilation</td>
<td>Complex will be well ventilated as per drawing and Specifications</td>
</tr>
<tr>
<td>Electrical Works</td>
<td>Quality electrical wiring will be done as per drawing and specifications</td>
</tr>
</tbody>
</table>
Rest Shelter 5 nos are proposed along the pathway. Rest shelter of size 2.85m x 1.65m is constructed in RCC and finishing work with neat cement munnins, moulding work, and cement primer painting work on complete.

6.2.9 Informative Display & Publicity work
Informative Display & Publicity work along the pathway and temple premises. Constructed with ashler masonry, wooden post, wooden jhalar, wooden roof covered with aluminum sheet.

6.2.10 Pathway Covering Shelter
Pathway Covering Shelter 5 nos are proposed along the pathway. Pathway Covering Shelter of size 10.0m x 2.20m is constructed by steel column and truss. C.G.S sheet with painting is proposed on Shelter roof.

6.2.11 View Deck
View Deck 5 nos are proposed along the pathway. View Deck size is 5.0m x 2.16m and local stone paving with railing on edge is proposed.

6.2.12 Dust Bins
There is a provision of 50 nos. (approx) ready-made dustbins along the pathway and temple premises

6.2.13 Solar Lighting
There is a provision of 25 (approx) solar lighting for temple along the pathway and temple premises.

6.2.14 Landscaping/Camping Site
There is a provision of grass and tree guard to enhance the landscaping in the surrounding area. Site development work is proposed.

6.2.15 Entrance Gate/Arch
Construction of new entrance gate proposed at beginning of the pathway. Entrance gate is proposed in RCC structure and finishing work with neat cement munnins, moulding work, and cement primer painting work on complete.

6.2.16 Lodging Facilities (Existing Dharamshala):
Renovation of 2 nos existing dharamshala, one of the size 20.0m x 6.80m and another of the size 7.0m x 3.70m has been proposed with stone cladding, internal plaster, CC flooring and painting work. Replacement of existing roof with PUF panel.
6.2.17 Solar Power Plant – 2 Kw Capacity:

Supply Installation and Commissioning of 2 KWp Solar Photo-Voltaic Power Plant with 2.50 KVA Inverter, Battery Bank of capacity 96V DC, 400 AH, Tubular Type Lead Acid / VRLA /GEL type Battery including all fitting fixing, Mounting Structure of Galvanized M.S. Angle, Crystalline SPV modules of capacity ranging between 80 Wp to 250 Wp to be connected in appropriate series-parallel combinations to form a SPV array of a minimum 2 KWp Capacity, Battery Stand, copper cabling of suitable size & rating, junction boxes with all other fitting & fixing, Energy meter of reputed make for measurement of energy usage from the Plant and civil foundation work to complete the job as per specification at Part – II (e) of Annexure – I on turn-key basis for stable & reliable operation including 5 years Warranty period from the date of commissioning of the plant (25 years Warranty period for SPV Modules).

TECHNICAL SPECIFICATIONS OF 2 KW SPV POWER PLANT

**i) SOLAR PV MODULE**

<table>
<thead>
<tr>
<th>Type of material</th>
<th>Mono/ Multicrystalline</th>
</tr>
</thead>
<tbody>
<tr>
<td>Make of Module</td>
<td>Reputed</td>
</tr>
<tr>
<td>Country</td>
<td>India</td>
</tr>
<tr>
<td>Cell of efficiency</td>
<td>&gt; 12-13 % and should be given good performance at the local insolation level.</td>
</tr>
<tr>
<td>Rating of module</td>
<td>80 Wp to 250 Wp</td>
</tr>
<tr>
<td>Solar Module frame material</td>
<td>Copper free aluminum</td>
</tr>
<tr>
<td>Nominal Voltage</td>
<td>12 V</td>
</tr>
<tr>
<td>Open Circuit voltage of Solar module</td>
<td>&gt; 21 V</td>
</tr>
<tr>
<td>Test Report</td>
<td>Should be laminated at the back side of the module.</td>
</tr>
</tbody>
</table>

A strip containing the following details **should be laminated** inside the module so as to be clearly visible from the front side:

- a) Name of the Manufacturer or distinctive Logo
- b) Model or Type No.
- c) Serial No.
- d) Year of make
- e) Name of Implementing Agency: TREDA.

**ii) MODULE MOUNTING STRUCTURE**

<table>
<thead>
<tr>
<th>Make</th>
<th>Reputed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Country of origin</td>
<td>India</td>
</tr>
<tr>
<td>Location</td>
<td>Roof / Ground / GCI Sheet mounting</td>
</tr>
<tr>
<td>Material</td>
<td>Angle Sections, Mild steel</td>
</tr>
<tr>
<td>Surface finish</td>
<td>Hot dip galvanized</td>
</tr>
<tr>
<td>Angle of tilt</td>
<td>20 to 25 degree</td>
</tr>
</tbody>
</table>

**Hardware**

i) The array structure shall be made of hot deep galvanized MS angles of size not less than 45 mm X 45 mm X 6 mm size. All nuts & bolts shall be made of very good quality Galvanized steel. The tilt angle of the Module Mounting Structure should be 20 - 25 degree as per requirement of site. Each Module Mounting Structure should be so designed to accommodate minimum of 4(four) SPV Modules as per site requirement and also should withstand wind speed upto maximum 200 Km per hour.

ii) The array structure should be designed based on the site...
### Foundation

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>1:2:4 (1 Cement: 2 River sand: 4 Jhama Brick aggregate 20 mm N/size) Cement Concrete at the size of minimum 1 ft. X 1 ft. X 1 ft.</td>
<td></td>
</tr>
</tbody>
</table>

### Height of the SPV Module

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>iii) At least 5 feet from the ground / roof level including the base foundation.</td>
<td></td>
</tr>
<tr>
<td>iv) At least 1 feet from GCI Sheet (Base foundation not required) in case the Modules are to be mounted at GCI sheet roof.</td>
<td></td>
</tr>
</tbody>
</table>

### Earthing materials & Lighting Arrester

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>i) For protection of SPV modules as per IE Acts earthing materials &amp; lighting arrester shall be provided-minimum 2 nos.</td>
<td></td>
</tr>
<tr>
<td>ii) All metallic structures shall be earthed as per standard.</td>
<td></td>
</tr>
</tbody>
</table>

Earthing including earthing pits, earthing strips, grouting conductor of GI strips (35 mm X 3 mm)(length as per site condition).

iii) Separate earth for PV array, PCU & Lighting arrester shall be provided.

iv) Lighting surge protection must be provided for the SPV array and other solar system components.

### iii) JUNCTION BOXES

<table>
<thead>
<tr>
<th>Type</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>i) <strong>Terminal Box</strong>: Terminal Box is a part of a module from which output is taken. Each PV Module is provided with one bypass diode in the terminal box.</td>
<td></td>
</tr>
<tr>
<td>ii) <strong>Series Junction Box</strong>: One series junction box is provided for each mounting structure for taking out final output. A blocking diode to be connected in series with modules in the box.</td>
<td></td>
</tr>
<tr>
<td>a) <strong>Blocking Diodes</strong>: These diodes are connected in series with string of PV modules and its functions are as follows:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Prevent circulating current between PV module strings.</td>
</tr>
<tr>
<td></td>
<td>Prevent reverse flow of current from battery through PV array during night and / or period of low insolation.</td>
</tr>
<tr>
<td>b) <strong>Bypass Diodes</strong>: These diodes are connected in reverse direction (anode to negative of PV module and cathode to positive of PV module) across each PV module of the strings. They have same current rating as that of blocking diodes and their operation is as follows:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Under normal operating conditions, the bypass diodes are reverse biased and play no part.</td>
</tr>
<tr>
<td></td>
<td>When any module in a series is shadowed, the current</td>
</tr>
</tbody>
</table>
through the module is reduced. Under these circumstances, the PV module gets reverse biased leading to power dissipation across the module and reduction in output power of which is undesirable. Presence of bypass diode provides an alternative path to flow of current in the string (as the diode becomes forward biased when PV module gets reverse biased) and also limits dissipation by limiting the voltage across PV module.

iii) Panel Junction Box: This is for paralleling various series junction boxes(SJB) outputs. Terminal Boxes are provided in the panel junction box for paralleling +ve & -ve electrical output from serial junction boxes. Single compression cable glands are used for all inlet outlet to ensure IP class 55 assembly.

iv) Array Junction Box: This is for paralleling –ve outputs from the individual panel junction boxes. A bus bar is provided with suitable studs and lugs for paralleling –ve electrical outputs from panel junction boxes.

<table>
<thead>
<tr>
<th>Construction</th>
<th>Weather proof</th>
</tr>
</thead>
<tbody>
<tr>
<td>Material</td>
<td>FRP/ Thermo Plastic/polycarbonate</td>
</tr>
<tr>
<td>Colour</td>
<td>Suitable</td>
</tr>
<tr>
<td>Earthing Provision</td>
<td>To be Provided</td>
</tr>
<tr>
<td>Hardware’s</td>
<td>As required</td>
</tr>
<tr>
<td>Marking</td>
<td>Suitable ferules are to be provided to identify all the cables.</td>
</tr>
<tr>
<td>Mounting type</td>
<td>Structure</td>
</tr>
<tr>
<td>Cable entry</td>
<td>As required</td>
</tr>
<tr>
<td>Cable glands</td>
<td>As required</td>
</tr>
<tr>
<td>Accessories</td>
<td>As required</td>
</tr>
</tbody>
</table>

**iv) POWER CONDITIONING UNIT (INVERTER PLUS PWM CHARGE CONTROLLER).**

<table>
<thead>
<tr>
<th>Switching element</th>
<th>IGBT/MOSFET</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input voltage</td>
<td>From PV Module: Minimum 2 KW, 96 V nominal DC from Solar PV Array (Solar Modules ranging between 80 Wp to 250 Wp be connected in appropriate series &amp; parallel combinations so that the Array capacity is minimum 5 KWp. From AC Source: 230 V (± 10 %), 1 ph, 50 Hz(± .5 Hz).</td>
</tr>
<tr>
<td>Output voltage</td>
<td>Suitable for charging 96 V, 400 Ah @ C/ 10 hr. tubular</td>
</tr>
</tbody>
</table>
# Section 6 - Works Requirements

<table>
<thead>
<tr>
<th>Protection</th>
<th>plate lead acid /VRLA / GEL type battery bank from SPV array.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Short Circuit</td>
</tr>
<tr>
<td></td>
<td>Deep discharge</td>
</tr>
<tr>
<td></td>
<td>Over charging(Automatic trickle charge mode on full charge)</td>
</tr>
<tr>
<td></td>
<td>Input surge voltage</td>
</tr>
<tr>
<td></td>
<td>Over current( Load)</td>
</tr>
<tr>
<td></td>
<td>Battery reverse polarity</td>
</tr>
<tr>
<td></td>
<td>Solar array reverse polarity</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Indication ( LED / LCD indication)</th>
<th>String on</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mains on</td>
</tr>
<tr>
<td></td>
<td>Input on</td>
</tr>
<tr>
<td></td>
<td>Control on</td>
</tr>
<tr>
<td></td>
<td>Charger on</td>
</tr>
<tr>
<td></td>
<td>80 % charged, 100 % charged</td>
</tr>
<tr>
<td></td>
<td>Charger overload</td>
</tr>
<tr>
<td></td>
<td>Battery on trickle</td>
</tr>
<tr>
<td></td>
<td>Battery disconnected/ Fault battery reverse polarity</td>
</tr>
<tr>
<td></td>
<td>Low Solar Power</td>
</tr>
<tr>
<td></td>
<td>System fault</td>
</tr>
<tr>
<td></td>
<td>Charger over temperature</td>
</tr>
<tr>
<td></td>
<td>Input over/ under voltage(for AC)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Operating Temp</th>
<th>0-50 Deg C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Humidity</td>
<td>0-95 % non-condensing</td>
</tr>
<tr>
<td>Enclosure</td>
<td>IP 32</td>
</tr>
<tr>
<td>No load consumption</td>
<td>&lt; 1 %</td>
</tr>
<tr>
<td>Cable glands, cable ferrule, clamping tool &amp; lug</td>
<td>Suitable for different size of Cable.</td>
</tr>
<tr>
<td>Lying, Termination, Glanding, Ferruling, copper lugs</td>
<td>Grid connection to ACDB, ACDB to PCU &amp; PCU to ACDB &amp; ACDB to Load shall be arranged</td>
</tr>
<tr>
<td>v) INVERTER</td>
<td>Grid connection to ACDB, ACDB to PCU &amp; PCU to ACDB &amp; ACDB to Load shall be arranged</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Nominal capacity</th>
<th>2.50 KVA</th>
</tr>
</thead>
</table>
| Input voltage    | From PV: Minimum 5 KW, 96 V nominal DC from Solar PV Array (Solar Modules ranging between 80 Wp to 250 Wp be connected in appropriate series & parallel combinations so that the Array capacity is minimum 2 Kw).
<p>|                  | From AC Source: 230 V (± 10 %), 1 ph, 50 Hz(± .5 Hz). |
| Output voltage   | 230 V, 50 Hz, 1 – phase. |
| Regulation       | From minimum to maximum voltage 1 % |
| Output frequency | 50 Hz (± 0.5 Hz) |
| Overload capacity | 150 % of the continuous rating for 30 seconds |</p>
<table>
<thead>
<tr>
<th>Efficiency</th>
<th>More than 90 % at full load, 0.8 PF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Short circuit protection</td>
<td>Circuit breaker and electronic protection</td>
</tr>
<tr>
<td>Low battery voltage</td>
<td>Automatic shutdown</td>
</tr>
<tr>
<td>Total harmonic distortion</td>
<td>Less than 3 %</td>
</tr>
<tr>
<td>Protection</td>
<td>Over voltage both at input and output, over current both at input and output, over frequency, surge voltage induced at output due to external source</td>
</tr>
<tr>
<td>Instrumentation &amp; indication (should be fixed internally or externally)</td>
<td>Input and output voltage, input and output current, frequency, power output, different status of inverter, kind of fault by LED and audio signal, CT meter for checking of input &amp; output current</td>
</tr>
<tr>
<td>Operating Temp</td>
<td>0-50 Deg C</td>
</tr>
<tr>
<td>Humidity</td>
<td>0-95 % non-condensing</td>
</tr>
<tr>
<td>Enclosure</td>
<td>IP 32</td>
</tr>
<tr>
<td>Cable glands</td>
<td>Suitable for different type of Cable.</td>
</tr>
<tr>
<td>Low battery cutoff</td>
<td>1.85 V / cell</td>
</tr>
<tr>
<td>Auto change over facilities from Solar power to AC mains and vice versa</td>
<td>1 phase auto changeover switch of suitable rating for cut in &amp; cut off of SPV power &amp; grid power should be provided at load side.</td>
</tr>
<tr>
<td>Automatic Control system to be provided</td>
<td>In the situation of battery on trickle charge, drawing charging current less than the rated one, the excess SPV Power generated from the plant will be routed to the load through inverter. This will be reversed automatically when the battery is drawing normal charging current.</td>
</tr>
</tbody>
</table>

**vi) DC/AC DISTRIBUTION BOARD**

| DCDB | Circuit-I( from Array) 63A DC Circuit Breaker: 2 Nos. (1 in use, 1 standby) |
| ACDB | Incoming Circuit-I ( from inverter) 63 A AC Circuit Breaker: 2 No. (1 in use, 1 standby) Outgoing: 32 A DP MCB: 4 nos.(3 in use, 1 standby) |
| Panel type | Wall mounting type & CRCA 2.5 mm thick with IP 32 protection |
| Cable Gland suitable to | Incoming & outgoing cable |

**vii) CABLES & LUGS**

<p>| Make | Reputed make as per ISI specification |
| Country of origin | India |
| Standard | 1.1 KV grade as per IS 694 |
| Connectors &amp; Termination | Cable terminations shall be made with aluminium/tinned copper crimped type solder less lugs |</p>
<table>
<thead>
<tr>
<th><strong>Cable Identification</strong></th>
<th>Cable tags shall be of 2mm thick aluminium strap of suitable length to contain cable number, equipment no, etc.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>2.3 Ferrules</strong></td>
<td>Ferrules shall be of approved type size to suit core size mentioned and shall be employed to designate the various cores of cable by the terminal numbers to which the cores are connected for case in identification and maintenance.</td>
</tr>
<tr>
<td><strong>Cable Glands</strong></td>
<td>Cable glands to be supplied shall be nickel-plated Brass double compression type of reputed make.</td>
</tr>
<tr>
<td><strong>Cable Trays</strong></td>
<td>This shall be either prefabricated hot dip galvanized sheet steel tray.</td>
</tr>
</tbody>
</table>
| **Cable Laying**         | i) All cable routes shall be carefully measured and cables cut to the required lengths, leaving sufficient lengths for the final connection of the cable to the terminal of the equipment. Cable laid on supporting angle in cable trenches, structures, columns and vertical run of cable trays shall be suitably clamped by means of G.I Saddles/Clamps, where as cable in horizontal run of cable trays shall be tied by means of nylon cords. Supporting steel shall be painted before laying of cables. The painting shall be done with one coat red lead paint and two coats of approved bituminous aluminium paint unless otherwise specified.  
   
   ii) All cables shall run inside flexible PVC pipes duly clamped with the mounting surface as the case may be. Cable marker shall be used. |
| **Cables used for various connections are given below:** | |
| a) PV Module to Terminal Box | 1 X 2.5 sq. mm PVC insulated, sheathed, unarmoured copper cable for series connection of PV Modules. |
| b) Terminal Box to Panel Junction Box. | 1 X 4 sq. mm PVC insulated, sheathed unarmoured copper cable, Red for +ve & Black for –ve. |
| c) Panel junction box to Array junction box | 1 X 10 sq. mm PVC insulated, sheathed, unarmoured copper cable, Red for +ve & Black for –ve. |
| d) Array junction box to PCU | 1 X 16 sq. mm PVC insulated, sheathed, unarmoured copper cable. Red for +ve & Black for –ve. |
| e) PCU to Battery Bank | 1 X 16 sq. mm PVC insulated, sheathed, unarmoured copper red cable for +ve terminal.  
  1 X 16 sq. mm PVC insulated, sheathed, unarmoured copper black cable for -ve terminal. |
f) Inverter to ACDB to Load

2 X 25 sq. mm PVC insulated, sheathed, unarmoured copper cable.

**viii) BATTERY BANK**

<table>
<thead>
<tr>
<th>Type</th>
<th>Low self discharge, Lead acid, Flooded electrolyte, tubular plate battery, provided with ceramic vent plugs or VRLA / GEL Type.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Country of origin</td>
<td>India</td>
</tr>
<tr>
<td>Nominal Voltage</td>
<td>2.0 V/ cell</td>
</tr>
<tr>
<td>End cell voltage</td>
<td>1.85 V/ cell (27 Deg C)</td>
</tr>
<tr>
<td>No. of Cells</td>
<td>48 in series</td>
</tr>
<tr>
<td>Battery capacity</td>
<td>400 Ah (at c/10 discharge rate)</td>
</tr>
<tr>
<td>Self discharge</td>
<td>4 % @ 30 Deg C per month</td>
</tr>
<tr>
<td>Charging Efficiency</td>
<td>93 % @ 20 Deg DOD (i.e. 80 % Soc)</td>
</tr>
<tr>
<td>Battery Bank in Ah (C 10)</td>
<td>400 Ah</td>
</tr>
<tr>
<td>Battery Capacities</td>
<td>Measured at 27 Deg C</td>
</tr>
<tr>
<td>Distilled Water</td>
<td>Not less than once in 6 month after topping up Frequency commission</td>
</tr>
<tr>
<td>Battery Accessories</td>
<td>Provided</td>
</tr>
<tr>
<td>Marking</td>
<td>+ ve &amp; - ve terminal shall be marked boldly on the terminals along with color indication Black- negative Red – positive</td>
</tr>
<tr>
<td>Terminals</td>
<td>1 No. of positive 1 No. of negative</td>
</tr>
<tr>
<td>Accessories</td>
<td>2(two) nos. of Micro porous Vent Plugs (ceramic)/cell</td>
</tr>
</tbody>
</table>

**ix) BATTERY RACK**

<table>
<thead>
<tr>
<th>Construction</th>
<th>Sal wood</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of Battery racks</td>
<td>Suitable for 96 Volt, 400 Ah, C10</td>
</tr>
<tr>
<td>No. of tiers</td>
<td>Double</td>
</tr>
<tr>
<td>No. of Rows</td>
<td>Double</td>
</tr>
</tbody>
</table>

**x) SPECIFICATION OF ENERGY METER (ISI MARKED)**

<table>
<thead>
<tr>
<th>Type</th>
<th>Electronic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal Voltage</td>
<td>230 V – 240 V</td>
</tr>
<tr>
<td>Current Rating</td>
<td>0 – 40 Amps.</td>
</tr>
</tbody>
</table>

**Furniture**: - The bidder will mention Brand Name, Model No. and also provide a catalog of the furniture proposed, with the bid. The bidder will supply only after approval of Employer.

**Accessories**: - The bidder will submit One (01) sample of each accessory for approval of Employer prior to supply.
6.3 General Specifications of Civil Works:

The bidders are also advised that for the purpose of execution of Works under the ADB-funded IDIPT-UTDB Project, the specifications to be followed are as under.

A. General

1. Reference mentioned herein shall be applicable to all sub-sections of this Section on Specifications to the extent the context permits and are intended to supplement the provisions in the particular sub-section. In case of any discrepancy/deviation, the provisions in the particular sub-section shall take precedence.

2. The rates for all items of work unless clearly specified otherwise shall include cost of all labor, materials and other inputs involved, complete and as required to the satisfaction of the Engineer / Project Manager, PIU as applicable in the execution of the items.

3. The Project Director, PMU / Project Manager, PIU when delegated, shall be the sole deciding authority as to the meaning, interpretation and implications for various provisions of the specifications.

Wherever any reference is made to any Indian Standard [e.g. Codes / Standards / Manuals of Bureau of Indian Standard (IS), Indian Roads Congress (IRC), Ministry of Road Transport & Highways (MOR&TH), etc.] it shall be taken as reference to the latest edition with all amendments issued thereto or revisions thereof if any, up to the date of submission of bid. In the event of any variation between the Specifications the PWD Schedule of Rates (2013-2014) of Block Augustmuni, Uttarakhand shall prevail.

4. Reference to the CPWD Specifications and the Indian Standard, the former shall take precedence over the later.

5. The Work shall be carried out in accordance with architectural drawings and structural drawings, to be issued by the Engineer / Project Manager, PIU as applicable. The structural and architectural drawings shall have to be properly co-related before executing the Work, and in case of any difference noticed between architectural and structural drawings, final decision, in writing of the Engineer / Project Manager, PIU shall be obtained by the Contractor. The Work shall include the sequence of work activities from clearing the site / leveling if any, correctly laying out the structural footprint, all construction activities thereafter, commissioning and handover of the completed Work to the Employer. For items where so required, samples shall be prepared before starting the particular items of Work for the prior approval of the DSC and/or Project Manager / Engineer, PIU, and nothing extra shall be payable on this account.
6. **Site**: The ‘site’ shall mean the land/ or other places on, in, into or through which the Work is to be executed under the Contract or any adjacent land, path or street through which the Work is to be executed under the Contract, or any adjacent land, path or street which may be allotted or used for the purpose of carrying out the Contract.

7. **Store**: The ‘store’ shall mean the place of issue of materials included in the appropriate schedule of a contract for issue by the UK PWD as applicable. In all other cases ‘Store’ shall mean any UK PWD store as applicable in the district as applicable.

8. **Best**: The word ‘best’ when used shall mean that in the opinion of the Project Manager / Engineer, PIU as applicable, there is no superior material / article and workmanship obtainable in the market and trade respectively. As far as possible the standard required shall be specified in preference to the word ‘best.’

9. **Department**: The ‘Department’ shall mean Uttarakhand Tourism Development Board (UTDB) (the Implementing Agency-IA), implementing the Work through the Program Implementation Unit (PIU) or Program Management Unit (PMU) as applicable.

10. **Floors and Levels**:  
    a. **Building:**  
       i. Floor 1 is the lowest floor above the ground level in the building unless otherwise specified in a particular case. The floors above floor 1 shall be numbered in sequence as floor 2,s. The number shall increase upwards.  
       ii. Floor level: For floor 1, top level of finished floor shall be the floor level and for all other floors above floor 1, top level of the structural slabs shall be the floor level.  
       iii. Plinth level: Floor 1 level or 1.2 m above the ground level whichever is lower shall be the plinth level.  
    b. **Special Structures:**  
       i. For structures like Fencing, retaining walls, wing walls, chimneys, overhead reservoirs/ tanks and other elevated structures, where elevations / heights above a defined datum level have not been specified and identification of floors cannot be done as in case of building. Level, at 1.2 m above the ground level shall be the floor 1 level as well as plinth level. Level at a height of 3.5 m above floor 1 level will be reckoned as floor 2 levels and level at a height of 3.5 m above the floor 2 level. Where the total height above floor 1 level is not a whole number multiple of 3.5 meter. Top most floor level shall be the next in sequence to the floor level below even if the difference in height between the two upper most floor levels is less than 3.5 meters.
11. **Foundation and Plinth:** The work in foundation and plinth shall include:

(a) For buildings: All works up to 1.2 metre above ground level or up to floor 1 level whichever is lower.

(b) For abutments, piers and well staining: all works up to 1.2 m above the bed level.

(c) For retaining wall, wing walls, compound walls, chimneys, overhead reservoirs/ tanks and other elevated structures: All works up to 1.2 meter above the ground level.

(d) For reservoirs / tanks (other than overhead reservoirs/ tanks): All works up to 1.2 meter above the ground level.

(e) For basements: All works up to 1.2 m above ground level or upto floor 1 level whichever is lower.

Note: Specific provision shall be made in the estimate for such situations where the foundation level is more than 3 (three) meter depth from the plinth for all types of structures mentioned above.

12. **Measurements:**

   a. In booking dimensions, the order shall be consistent and in the sequence of length, width and height or depth or thickness. The Work shall be executed, measured, and quantity arrived at as per the metric dimension given in the Schedule / Bill of Quantities, drawings etc.

   b. Rounding off: Rounding off where required shall be done in accordance with IS: 2-1960. The number of significant places rounded in the rounded off value should be as specified.

13. **Materials:**

   a. Samples of all materials to be used on the Work shall be got approved by the Contractor from the Project Manager / Executive Engineer, PIU as applicable well in time. The approved samples duly authenticated and sealed shall be kept in the custody of the Project Manager / Executive Engineer, PIU till the completion of the Work. All materials to be provided by the Contractor shall be brand new and as per the samples approved by the Project Manager / Executive Engineer, PIU.

   b. Materials obtained by the Contractor from the sources approved by the Department shall be subjected to the Mandatory tests. Where such materials do not conform to the relevant specifications, the matter shall be taken up by the Project Manager / Executive Engineer, PIU as applicable for appropriate action against the defaulters. In all such cases, necessary documents in original and proof of payment relating to the
procurement of materials shall be made available by the Contractor to the Project Manager / Executive Engineer, PIU.

c. Samples, whether submitted for approval to govern bulk supplies or required for testing before use and also the sample of materials bearing ‘Standard Mark,’ if required for testing, shall be provided free of cost by the Contractor. All other incidental expenditure to be incurred for testing of samples e.g. packaging, sealing, transportation, loading, unloading etc. to the satisfaction of Design and Supervision Consultant (DSC) and/or Project Manager / Executive Engineer, PIU shall be borne by the Contractor.

d. The materials, supplied by the Department, if any shall be deemed to be complying with the specifications.

e. Materials stored at site, depending upon the individual characteristics, shall be protected from atmospheric effects due to rain, sun, wind and moisture to avoid deterioration.

f. Materials like timber, paints etc. shall be stored in such a way that there may not be any possibility of fire hazards. Inflammable materials and explosives shall be stored in accordance with the relevant rules and regulations or as approved by Project Manager / Executive Engineer, PIU as applicable in writing so as to ensure desired safety during storage.

14. **Safety in Construction:**

a. The Contractor shall employ only such methods of construction, tools and plant as are appropriate for the type of work or as approved by Project Manager / Executive Engineer, PIU as applicable in writing.

b. The Contractor shall take all precautions and measures to ensure safety of works and workman and shall be fully responsible for the same. Safety pertaining to construction works such as excavation, centring and shuttering, trenching, blasting if any, demolition, electric connections, scaffolds, ladders, working platforms, gangway, mixing of bituminous materials, electric and gas welding, use of hoisting and construction machinery shall be governed by UK PWD Safety Code, relevant safety codes and the direction of Project Manager / Executive Engineer, PIU as applicable.

15. **An Indicative List of Codes**

An indicative list of Bureau of Indian Standards (BIS) IS Codes and IRC codes to be followed is as under, unless otherwise specified in the work item in technical specifications.

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Material / Work Type</th>
<th>IS Code</th>
<th>IS Code Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Earth Work</td>
<td>IS: 1498-1970</td>
<td>Classification and identification of soils for general engineering purposes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>IS: 3764-1992</td>
<td>Safety code for excavation work</td>
</tr>
<tr>
<td>S. No.</td>
<td>Material / Work Type</td>
<td>IS Code</td>
<td>IS Code Name</td>
</tr>
<tr>
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<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>2</td>
<td>Form Work</td>
<td>IS: 1730-1989</td>
<td>Dimensions for steel plates, sheets strips and flats for general engineering purposes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>IS: 808-1989</td>
<td>Dimensions for Hot Rolled Steel Beam, Column, Channel and Angle Sections</td>
</tr>
<tr>
<td></td>
<td></td>
<td>IS: 723-1972</td>
<td>Specification for Steel Countersunk Head Wire Nails</td>
</tr>
<tr>
<td>3</td>
<td>Aggregates</td>
<td>IS: 383-1970</td>
<td>Specification for coarse and fine aggregates from natural sources for concrete</td>
</tr>
<tr>
<td>4</td>
<td>Concrete Works</td>
<td>IS: 456-2000</td>
<td>Plain and Reinforced Concrete - Code of Practice</td>
</tr>
<tr>
<td></td>
<td></td>
<td>IS: 516-1959</td>
<td>Method of tests for strength of concrete</td>
</tr>
<tr>
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<td></td>
<td>IS: 1199-1959</td>
<td>Methods of sampling and analysis of concrete</td>
</tr>
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<td>IS: 2386-1963(1)</td>
<td>Methods of Test for Aggregates for Concrete - Part 1: Particle Size and Shape</td>
</tr>
<tr>
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<td></td>
<td>IS: 2386-1963(2)</td>
<td>Methods of test for Aggregates for Concrete - Part 2: Estimation of deleterious materials and organic impurities</td>
</tr>
<tr>
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<td></td>
<td>IS: 2386-1963(3)</td>
<td>Methods of test for Aggregates for Concrete - Part 3: Specific gravity, density, voids, absorption and bulking</td>
</tr>
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<td></td>
<td>IS: 2386-1963(4)</td>
<td>Methods of test for Aggregates for Concrete - Part 4: Mechanical properties</td>
</tr>
<tr>
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<td></td>
<td>IS: 2645-2003</td>
<td>Integral Waterproofing Compounds for Cement Mortar and Concrete – Specification</td>
</tr>
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<td></td>
<td>IS: 3812-2003(2)</td>
<td>Pulverized Fuel Ash - Specification - Part 2: For Use as Admixture in Cement Mortar and Concrete</td>
</tr>
<tr>
<td>5</td>
<td>Ordinary Portland Cement (OPC) for Masonry and PCC works</td>
<td>IS: 269-1989</td>
<td>Specification for 33 grade Ordinary Portland Cement</td>
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<tr>
<td></td>
<td></td>
<td>IS: 455-1989</td>
<td>Specification for Portland Slag Cement</td>
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<td></td>
<td>IS: 8112-1989</td>
<td>Specification for 43 grade Ordinary Portland Cement</td>
</tr>
<tr>
<td>6</td>
<td>Ordinary Portland Cement (OPC) for RCC works</td>
<td>IS: 12269-1987</td>
<td>Specification for 53 grade Ordinary Portland Cement</td>
</tr>
<tr>
<td>7</td>
<td>Portland Pozzolana Cement (PPC) for other concrete work</td>
<td>IS: 1489-1991(relevant parts)</td>
<td>Specification for Portland Pozzolana Cement</td>
</tr>
<tr>
<td>S. No.</td>
<td>Material / Work Type</td>
<td>IS Code</td>
<td>IS Code Name</td>
</tr>
<tr>
<td>--------</td>
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</tr>
<tr>
<td>8</td>
<td>MS bars and wires</td>
<td>IS: 280-2006</td>
<td>Mild Steel Wire for General Engineering Purposes.</td>
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<tr>
<td></td>
<td></td>
<td>IS: 432-1982 (Part 1)</td>
<td>Specification for mild steel and medium tensile steel bars and hard-drawn steel wire for concrete reinforcement–Mild steel and medium tensile steel bars</td>
</tr>
<tr>
<td>9</td>
<td>Reinforcement Steel – Tor Steel (cold twisted deformed bars)</td>
<td>IS: 1786-2008</td>
<td>High strength deformed steel bars and wires for concrete reinforcement – Specification</td>
</tr>
<tr>
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<td>IS: 1122-1974</td>
<td>Method of test for determination of true specific gravity of natural building stones</td>
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<td>IS: 1123-1975</td>
<td>Method of identification of natural building stones</td>
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<tr>
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<td></td>
<td>IS: 1124-1974</td>
<td>Method of test for determination of water absorption, apparent specific gravity and porosity of natural building stones</td>
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<td></td>
<td></td>
<td>IS: 1125-1974</td>
<td>Method of test for determination of weathering of natural building stones</td>
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<td>IS: 1126-1974</td>
<td>Method of test for determination of durability of natural building stones</td>
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<tr>
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<td>IS: 1127-1970</td>
<td>Recommendations for dimensions and workmanship of natural building stones for masonry work</td>
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<td>IS: 1129-1972</td>
<td>Recommendation for dressing of natural building stones</td>
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<tr>
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<td></td>
<td>IS: 1805-1973</td>
<td>Glossary of terms relating to stones, quarrying and dressing</td>
</tr>
<tr>
<td>S. No.</td>
<td>Material / Work Type</td>
<td>IS Code</td>
<td>IS Code Name</td>
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<td>IS: 5454-1978</td>
<td>Methods of sampling of clay building bricks</td>
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<tr>
<td>12</td>
<td>Structural Steel</td>
<td>IS: 226-1975</td>
<td>Structural steel (Standard quality)</td>
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<td>14</td>
<td>PVC Door Work</td>
<td>IS: 4020-1998</td>
<td>Door Shutters - Methods of Tests (relevant parts)</td>
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<tr>
<td></td>
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<td>IS: 10151-1982</td>
<td>Specification for Polyvinyl Chloride (PVC) and its Copolymers for its Safe Use in Contact with Foodstuffs, Pharmaceuticals and Drinking Water</td>
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<td>IS: 14182-1994</td>
<td>Solvent cement for use with unplasticized polyvinylchloride plastic pipe and fittings</td>
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<td>15</td>
<td>Flooring Work</td>
<td>IS: 777-1988</td>
<td>Glazed earthenware wall tiles</td>
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<tr>
<td>16</td>
<td>Plastering and Distempering Work</td>
<td>IS: 1630-1984</td>
<td>Specification for mason's tools for plaster work and pointing work</td>
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<td>IS: 1635-1992</td>
<td>Code of practice for field slaking of building lime and preparation of putty</td>
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<td></td>
<td>IS: 2402-1963</td>
<td>Code of Practice for External Rendered Finishes</td>
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<tr>
<td>17</td>
<td>Door Fittings</td>
<td>IS: 1341-1992</td>
<td>Steel butt hinges - Specification</td>
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<td></td>
<td>IS: 208-1996</td>
<td>Door handles - Specification</td>
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<td>IS: 281-2009</td>
<td>Mild Steel Sliding Door Bolts for use with Padlocks - Specification</td>
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<td>IS: 1823-1980</td>
<td>Specification for floor door stoppers</td>
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<td>IS: 2681-1993</td>
<td>Non-ferrous metal sliding door bolts (aldrops) for with padlocks - Specification</td>
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<td>IS: 3400-2004</td>
<td>Methods of Test for Vulcanized Rubber - Part 2 : Rubber, Vulcanized or Thermoplastic - Determination of Hardness (Hardness Between 10 IRHD and 100 IRHD)</td>
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<td>S. No.</td>
<td>Material / Work Type</td>
<td>IS Code</td>
<td>IS Code Name</td>
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<td>IS: 4905-1968</td>
<td>Methods for random sampling</td>
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<td>IS: 733-1983</td>
<td>Specification for Wrought Aluminium and Aluminium Alloy Bars, Rods and Sections (for General Engineering Purposes)</td>
</tr>
<tr>
<td>18</td>
<td>Painting Work</td>
<td>IS: 57-1989</td>
<td>Red Lead for Paints and Other Purposes – Specification</td>
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<tr>
<td></td>
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<td>IS: 75-1973</td>
<td>Specification for Linseed Oil, Raw and Refined</td>
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<td>IS: 77-1976</td>
<td>Specification for Linseed Oil, Boiled, for Paints</td>
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<td>IS: 110-1983</td>
<td>Ready mixed paint, brushing, grey filler, for enamels for use over primers</td>
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<td></td>
<td>IS: 290-1961</td>
<td>Coal tar black paint</td>
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<td>IS: 324-1959</td>
<td>Specification for Ordinary Denatured Spirit</td>
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<td>IS: 384-2002</td>
<td>Brushes, Paints and Varnishes, Flat – Specification</td>
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<td>IS: 426-1961</td>
<td>Paste filler for colour coats</td>
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<td>IS: 486-1983</td>
<td>Specification for Brushes, Sash Tool, for Paints and Varnishes</td>
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<tr>
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<td>IS: 487-1997</td>
<td>Brushes, Paint and Varnish - (i) Oval, Ferrule Bound; and (ii) Round, Ferrule Bound</td>
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<td>IS: 533-2007</td>
<td>Gum spirit of turpentine (oil of turpentine) – Specification</td>
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<td>IS: 1459-1974</td>
<td>Specification for kerosene</td>
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<td>IS: 2333-1992</td>
<td>Plaster of Paris for ceramic industry</td>
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<td>IS: 2395-1994 (Part 2)</td>
<td>Painting of Concrete, Masonry and Plaster Surfaces - Code of Practice: Part 2 – Schedules</td>
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<td>IS: 2932-2003</td>
<td>Enamel, Synthetic, Exterior : (a) Undercoating (b) Finishing - Specification</td>
</tr>
<tr>
<td></td>
<td></td>
<td>IS: 2933-1975</td>
<td>Enamel exterior (a) undercoating, (b) finishing</td>
</tr>
<tr>
<td></td>
<td></td>
<td>IS: 5410-1992</td>
<td>Cement paint</td>
</tr>
<tr>
<td>19</td>
<td>Building measurement</td>
<td>IS: 2-1960</td>
<td>Rules for Rounding off Numerical</td>
</tr>
</tbody>
</table>
B. General Technical Specifications for Civil Works

Note: Whenever required during the execution, the amendments issued for respective specifications of PWD Schedule of Rates (2014-2015) OF Block 23 Pratap Nagar, Uttarakhand and CPWD for 2012-2013, DELHI SCHEDULE OF RATES, Building Works Based on CPWD.

As applicable shall supersede the current specifications given in the bid document.

For Civil Works specifications adopted of PWD Schedule of Rates (2014-2015) of Block 23 Pratap Nagar, Uttarakhand, specifications from CPWD Specifications, 2009 (Vol. 1 or 2 as applicable) or specifications from market for the non-schedule items in the said sequence of preference for specifications shall be followed.

1. EXCAVATION

1.1 General

All excavations shall be carried out in conformity with directions laid herein under and in a manner approved by the Engineer. The work shall be done that the suitable materials available from excavation are satisfactorily utilized as decided upon beforehand.

While planning or executing excavations, the Contractor shall take all adequate precautions against soil erosion, water pollution etc.

The excavations shall conform to the lines, grades, side slopes and levels shown on the drawings or as directed by the Engineer. The Contractor shall not excavate outside the slopes or below the established grades or loosen any material outside the limits of excavation. Subject to the permitted tolerances, any excess depth excavated below the specified levels on the roadway shall be made good at the cost of the Contractor with suitable material of similar characteristics to that removed and compacted to the requirements of ISI Specifications.

All debris and loose material on the slopes of cuttings shall be removed. No backfilling shall be allowed to obtain required slopes excepting that when boulders or soft materials are encountered in cut slopes these shall be excavated to approved...
depth on instructions of the Engineer and the resulting cavities filled with suitable material and thoroughly compacted in an approved manner.

Roadway and drain excavation shall consist of excavation, removal and satisfactory disposal of all materials necessary for the construction of road-way, side ditches and waterways, in accordance with the requirements of these specification and the lines, grades and cross-sections shown in the drawings or indicated by the Engineer. This work shall include the hauling and stacking of or hauling to sites of embankment construction, of suitable cut materials as required, as also the disposal of unsuitable cut materials in specified manner and the trimming and finishing of the roadway.

The classification of earth work shall be done by the Engineer and the intermediate classification like P.J./J.B./P.J.B. etc. shall be paid proportionately.

All excavation shall be done as per the profile indicated by the Engineer.

Excavation shall be carried out to the required lines and levels, widths and depths, so that dimensions of the permanent work shall not be less than what is indicated.

The whole of the excavated material shall be brought to the surface and disposed off as directed.

Selected and approved excavated stuff required for filling etc. shall be kept separated for reuse as directed.

The phasing and method of excavations for all foundation and earthwork shall be to the approval of the Engineer.

No permanent construction shall be started over the excavated surface until and unless approved by the Engineer.

Excavations taken wider or deeper than required to contain the permanent work shall be filled in at the Contractor's expense. (However, exceptions may be specially permitted in certain situations as indicated here-in-after).

Excavations taken wider than required shall be filled back with selected material thoroughly compacted in layers of 150 mm thickness.

Back filling of wrongly excavated trenches shall be done with lean cement concrete or other material if so indicated under the respective situations, described in subsequent paragraphs of this specification, so as to bring it back to the appropriate section.

1.2 Classification of Excavated Material

All materials used in excavation shall be classified by the Engineer in the following groups.

1.2.1 Ordinary Soil
This shall comprise vegetable or organic soil, turf, sand, silt, loam, clay, mud, peat, black cotton soil, soft shale or loose moorum, a mixture of these and similar materials which yields to the ordinary application of pick and shovel, rake phawrahs or other ordinary digging implement. Removal of gravel or any other nodular material having diameter in anyone direction not exceeding 75 mm occurring in such strata shall be deemed to be covered under this category. Generally this type of soil has dry bulk density less than 1.6 gm/cc.

1.2.2 Hard Soil

Any soil which generally requires the close application of picks or jumpers or scarifiers to loosen it. Stiff Clay, Gravel and Cobble Stone etc. fall under this category. This shall include:

i) Stiff heavy clay, hard shale, or compact moorum requiring grafting tool or pick or both and shovel, closely applied;

ii) Gravel and cobble stone having 'maximum diameter in any one direction between 75 and 300 mm;

iii) Soling of roads, paths etc., and hard core;

iv) Macadam surfaces such as water bound, and bitumen/tar bound;

v) Lime concrete, stone masonry in lime mortar and brick work in lime/cement mortar, below ground level;

vi) Soft conglomerate, where the stones may be detached from the matrix with picks; and

vii) generally any material which requires the close application of picks, or scarifiers to loosen and not affording resistance to digging greater than the hardest of any soil mentioned in (i) to (vi) above.

Generally such type of soil has bulk density 1.6 gm/cc and above except Sandy soils.

1.2.3 Ordinary Rock (not requiring blasting)

This shall include:

i) Limestone, sandstone, laterite, hard conglomerate or other soft or disintegrated rock which may be quarried or split with crowbars;

ii) Unreinforced cement concrete which may be broken up with crowbars or picks and stone masonry in cement mortar below ground level;

iii) Boulders which do not require blasting, having maximum diameter in any direction of more than 300 mm, found lying loose on the surface or embedded in river bed soil, talus, slope wash and terrace material of dissimilar origin; and
iv) Any rock which in dry state may be hard. Requiring blasting, but which when wet becomes soft and manageable by means other than blasting.

1.2.4 Hard Rock (requiring blasting)

This shall comprise:

i) any rock or cement concrete for the excavation of which the use of mechanical plant or blasting is required;

ii) reinforced cement concrete (reinforcement cut through but not separated from the concrete) below ground level; and

iii) Boulders requiring blasting.

1.2.5 Hard Rock (blasting prohibited)

Hard Rock requiring blasting as described under Clause 2.2.1 (d) below but where blasting is prohibited for any reason and excavation has to be carried out by chiselling, wedging or any other agreed method.

1.2.6 Marshy Soil

This shall include soils excavated below the original ground level of marshes and swamps and soils excavated from other areas requiring continuous pumping or bailing out of water.

1.3 Authority for Classification

The classification of excavation shall be decided by the Engineer and his decision shall be final and binding on the Contractor. Merely the use of explosives in excavation will not be considered as a reason for higher classification unless blasting is clearly necessary in the opinion of the Engineer.

1.3.1 Spade Work

In case of Spade Work the application of spade/phawrah, rake etc., is required. Blasting is not required under this work.

1.3.2 Pick Work

In case of Pick Work the application of pick axes, shovels, etc. is required. Blasting is not required for this work.

1.3.3 Jumper Work

In case of Jumper Work application of crowbars, pick axes etc. is required. The Jumper Work also requires mild blasting work. The rates for the explosives such as Special Gelatin 80%, Detonators, Safety fuse coil and labour such as Driller, Blaster and Beldars have been included in the rate of Jumper Work. The rates for the drilling equipment have also been included.

1.3.4 Chiselling/Wedging out of Rock

Where the blasting is prohibited and soft or hard rock is to be removed the chiselling has to be resorted to. Chiselling may be done in soft rock or hard for which different
rates are applicable. The excavation has to be done by Chiselling/Wedging or by any other suitable method. The rates for Chiseller/Breaker, Black Smith and Beldars have been included in the case of the Chiselling of Soft Rock as well as that of Hard Rock.

1.4 Construction Operations

1.4.1 Setting out

After the site has been cleared, the limits of excavation shall be set out true to lines, curves, slopes, grades and sections as shown on the drawings or as directed by the Engineer. The Contractor shall provide all labour, survey instruments and materials such as strings, pegs, nails, bamboos, stones, lime, mortar, concrete, etc., required in connection with the setting out of works and the establishment of bench marks. The Contractor shall be responsible for the maintenance of bench marks and other marks and stakes as long as in the opinion of the Engineer they are required for the work.

1.4.2 Stripping and Storing top Soil

When so directed by the Engineer, the top soil existing over the sites of excavation shall be stripped to specified depths and stored at designated locations for reuse in covering embankment slopes, cut slopes, berms and other disturbed areas where re-vegetation is desired.

1.4.3 Rock Excavation

Rock, when encountered in roadway excavation, shall be removed up to the sub grade level or as otherwise indicated on the drawings. Where, however, unstable shales or other similar materials are intersected at the subgrade level, these shall be excavated to the extent of 500 mm below the subgrade level or as otherwise specified. In all cases, the excavation operations shall be carried out that at no point on cut formation the rock protrudes above the specified levels, provided, however, that a negative tolerance of 150 mm shall be permissible.

Where excavation is done to levels lower than those specified, the excess excavation shall be made good by hand packing with rubble and chips to the designated level and compacting to the satisfaction of the Engineer.

Slopes in the rock cutting shall be finished to uniform lines corresponding to slope lines shown on the drawing or as directed by the Engineer. Notwithstanding the foregoing all loose pieces of rock on excavated slope surface which move when prised by a crowbar shall be removed.

1.4.4 Marsh Excavation
The excavation of marches/swamps shall be carried out as per programme laid down by the Engineer.

Excavation of marshes shall begin at one end and proceed in one direction across the entire marsh immediately ahead of back-filling. The method and sequence of excavating and back filling shall be such as to assure, to the extent practicable, the complete removal or displacement of all muck from within the lateral limits called for on the drawings or as stated by the Engineer, and to the bottom of the marsh, firm support or levels indicated.

1.4.5 Excavation of road shoulders for widening of pavement
In works involving of existing pavements unless otherwise specified, the shoulders shall be removed to their full width and to levels shown on the drawings or as indicated by the Engineer. While doing so, care shall be taken to see that no portion of the existing pavement designated to be retained is loosened or disturbed.

1.4.6 Dewatering
If water is met within the excavations due to springs, seepage, rain or other causes, it shall be removed by suitable diversions, pumping or bailing out and the excavation kept dry whenever so required or directed by the Engineer. Care shall be taken to so discharge the drained water as not to cause damage to the works, crops or any other property.

1.4.7 Disposal of excavated materials
All the excavated materials shall be the property of the Government. The operations shall be so arranged that the capacity of cutting, haulage and compaction is nearly the same.

All hard materials, such as hard moorum, rubble etc. not intended for use in the bank, shall be stacked neatly on Government land as directed by the Engineer, within the lead specified for the item, for future use such as pitching. Unsuitable and surplus materials not intended for use in any part of the road shall be disposed off as directed by the Engineer.

1.5 Useful Materials and Finds
Any useful material obtained from the excavation shall be stacked separately in regular stacks as directed by the Engineer and shall remain the property of the Government. Any finds such as relics of antiquity, coins, fossils or other articles of value shall delivered to the Engineer and shall also remain the property of the Government.

1.6 Earthwork for Levelling the Area
1.6.1 Setting out and making profiles

1.6.1.1 Masonry pillars will erected at suitable points in the area to serve as bench marks for the execution of the work. These bench marks shall be connected with G.T.S or any other bench mark approved by the Engineer. Necessary profile with pegs, bamboos and strings of "Burjis" shall be made to show the correct formation levels before the work is started. The Contractor shall supply labour and materials for setting out and making profiles and "Burjis" for the work at his own cost. The profiles and "Burjis" shall also be maintained by him during the execution of work.

1.6.1.2 The ground levels shall be taken at 5 to 15 metres intervals in level on uniformly sloping ground and, at closer intervals where local, mounds pits or undulations are met with, as directed by the Engineer. The ground levels shall be recorded in field books and plotted on a plan, which shall be signed by the Contractor and the Engineer before earth work is started and labour required for taking levels shall be supplied by the Contractor at his own cost.

1.6.2 Rough Excavation

1.6.2.1 Excavation not requiring dressing of sides and bottom and reduction to exact levels, such as winning earth from borrow pits, hill side cutting etc. shall be described as "Rough Excavation" and given in cubic metres.

1.6.3 Cutting and Filling

1.6.3.1 Cutting shall be done from top to bottom. Under-mining, or under-cutting shall not be allowed. The earth from cutting shall be directly used for filling and no claim of double handling of earth shall be entertained. Filling shall be done in regular layers, each layer not exceeding 20 cms in depth. The earth used for filling shall be free from all roots, grass and rubbish and all lumps and clods exceeding 8 cms in any direction shall be broken down. Each layer shall be consolidated by breaking clods and ramming. Watering shall be done, if so stipulated and as required. The top surface of the finally finished area shall be neatly dressed.

1.6.3.2 Where consolidation of filling or banking is specified each layer of earth shall be adequately watered to aid compaction. It shall then be rolled with roller of minimum half tonne weight not less than five times till it gets evenly and densely consolidated. Where roller cannot work, the earth shall be consolidated with wooden or steel rammers of seven to ten kilograms weight having a base of 20 cms square of 20 cms diameter. The labour for ramming shall be at least one rammer to six diggers. Every third layer of earth and the topmost layer shall be well consolidated with power roller of minimum eight tonne weight, not less than five times till the soil
behaves as an elastic material and gets compressed under the load of roller. Before placing the next layer, the surface of the under layer shall be moistened and scarified with pick axes or spades, so as to provide a satisfactory bond with the next layer. The top surface of the finally finished area shall be neatly dressed.

1.6.3.3 All cutting shall be done to the required levels. Should cutting be taken deeper, such extra excavation shall not be measured for payment. Further the bottom of excavation shall be brought to required levels by filling in with suitable earth duly consolidated at the Contractor’s cost. However in case of hard rock. Where blasting operations have been resorted to, cutting shall be measured to the actual levels, provided the Engineer is satisfied that the Contractor has not gone deeper than what was unavoidable.

1.6.3.4 The finished formation levels, in case of filing shall be kept higher than the required levels by making and allowance of 10% of depth of filing for future settlement in case of ordinary consolidated fills and 5% in case where the consolidation is done by heavy mechanical means.

1.6.3.5 During the execution of work, the natural drainage of the area shall be maintained by the Contractor.

1.7 Plying of Construction Traffic

Construction traffic shall not use the cut formation without the prior permission of the Engineer. Any damage arising out of such use shall be made good by the Contractor at his own expense.

1.8 Preservation of Property

The Contractor shall undertake all reasonable precautions for the protection and preservation of any or all existing roadside trees, drains, sewers to other sub-surface drains, pipes, conduits and any of the structure under or above ground, which may be affected by construction operations and which in the opinion of the Engineer shall be continued in use without any change. Safeguards taken by the Contractor in this respect, shall be got approved by him from the Engineer. However, if any of these objects is damaged by reason of the Contractor’s negligence, it shall be replaced or restored to the original condition at his expense.

1.9 Measurements for Payments

Roadway and drain excavation shall be measured by taking cross-sections at suitable intervals in the original position before the work starts and after its completion and computing the volumes in cubic metres by the method of average end area. Where it is not feasible to compute volumes by this method because of
erratic location of isolated deposits) the volumes shall be computed by other accepted methods.

At the option of the Engineer, the Contractor shall leave depth indicators during excavations of such shape and size and in accurately as directed so as to indicate the original ground level as accurately as possible. The Contractor shall see that these remain intact till the final measurements are taken.

For rock excavation the overburden shall be removed first so that necessary cross section could be taken for measurement. Where cross sectional measurements could not be taken due to irregular configuration or where the rock is admixed with other classes of materials, the volumes shall be computed as per the direction of Engineer.

The Lead and lift shall be measured from the centre of gravity of the excavated earth to that of the placed earth, for such measurements the earth work proposed to be worked upon shall be demarcated in sections economically for placement of Excavated Earth. The mean lead and lift shall be Calculated Separately for such sections.

When earth has to be carried over a spoil bank and dumped beyond it, the mean lift would be the difference in level between centre of gravity of the excavated earth and top of the spoil bank omitting the dowel.

The rates provided for additional leads are valid for distances upto 300 metres for disposals done manually. However, the most economical mode i.e. manual (including the use of wheel barrows), animal transport or mechanical transport shall be decided by the Engineer and paid as such according to the relevant schedule of rates for manual, animal or mechanical transport.

1.10 Rate

The rates for the items of excavation shall be paid for carrying out the required operations as described for the individual items. These rates do not include the cost of pumping out of water which shall normally be done departmentally. Whenever work is to be get done by contract, the rate shall be settled before execution on the merits of the individual case. The labour rates do not include the expenses on account of Compressor. The rates include all labour, materials, tools, safe guards and incidentals necessary to complete the work to the specifications within specified leads and lifts. Contractor’s profit @ 10% and overhead changes @ 5% have been included in the rate.
2. EXCAVATION FOR FOUNDATION, DRAINS, CHANNELS, PIPES AND CABLES

2.1 Description

Excavation for structures shall consist of the removal of material for the construction of foundations for bridges, culverts, retaining walls, headwalls, cut of walls, pipe culverts and other similar structures in accordance with the requirements of these specifications and the lines and dimensions shown on the drawings or as indicated by the Engineer. The work shall include construction of the necessary cofferdams and cribs and their subsequent removal; all necessary sheeting, shoring, bracing, draining, and pumping; the removal of all logs, stumps, grubs and other deleterious matter and obstructions necessary for placing the foundations; trimming bottoms of excavations; backfilling and clearing up the site, and the disposal of all surplus material.

2.2 Classification of Excavated Material

2.2.1 All materials involved in excavation shall be classified by the Engineer in the following groups:

(a) Ordinary Soil

This shall comprise vegetable or organic soil, turf, sand, silt, loam, clay, mud, peat, black cotton soil, soft shale or loose moorum a mixture of these and similar material which yields to the ordinary application of pick and shovel, rake or other ordinary digging implement. Removal of gravel or any other nodular material having diameter in any one direction not exceeding 75 mm occurring in such strata shall be deemed to be covered under this category.

(b) Hard Soil

This shall include:

i) stiff heavy clay, hard shale or compact moorum requiring grafting tool or pick or both and shovel, closely applied;

ii) gravel and cobble stone having maximum diameter in any one direction between 75 and 300 mm;

iii) soling of road, paths, etc., and hard core;

iv) macadam surface such as water bound, and bitumen/tar bound;

v) lime concrete, stone masonry in lime mortar and brick work in lime/cement mortar, below ground level;

vi) soft conglomerate, where the stones may be detached from the matrix with picks; and
vii) generally any material which requires the close application of picks, or scarifiers to loosen and not affording resistance to digging greater than the hardest of any soil mentioned in (i) to (vi) above.

(c) Ordinary Rock (not requiring blasting)

This shall include:

i) limestone, sandstone, laterite, hard conglomerate or other soft or disintegrated rock which may be quarried or split with crowbars;

ii) unreinforced cement concrete which may be broken up with crowbars or picks and stone masonry in cement mortar below ground level;

iii) boulders which do not require blasting having maximum diameter in any direction of more than 300 mm, found lying loose on the surface or embedded in river bed, soil, talus, slope wash and terrace material of dissimilar origin; and

iv) any rock which in dry state may be hard, requiring blasting, but which when wet becomes soft and manageable by means other than blasting.

(d) Hard Rock (requiring blasting)

This shall comprise:

i) any rock or cement concrete for the excavation of which the use of mechanical plant or blasting is required;

ii) reinforced cement concrete (reinforcement cut through but not, separated from the concrete) below ground level; and

iii) boulders requiring blasting.

(e) Hard Rock (blasting prohibited)

Hard rock requiring blasting as described under Clause 2.2.1 (d) above but where blasting is prohibited for any reason and excavation has to be carried out by chiselling wedging or any other agreed method.

(f) Marshy Soil

This shall include soils excavated below the original ground level of marshes and swamps and soils excavated from other areas requiring continuous pumping or bailing out of water.

2.2.2 Authority for Classification

The classification of excavation shall be decided by the Engineer and his decision shall be final and binding on the Contractor. Merely the use of explosives in excavation will not be considered as a reason for higher classification unless blasting is clearly necessary in the opinion of the Engineer.

2.3 Construction Operations
2.3.1 Setting Out

After the site has been cleared, the limits of excavation shall be set out true to lines, curves and slopes.

2.3.2 Excavation

Excavation shall be taken to the width of the lowest step of the footing and the sides shall be left plumb where the nature of soil allows it. Where the nature of soil or the depth of the trench does not permit vertical sides, the Contractor at his own expense shall put necessary shoring, strutting and planking or cut slopes to after angles/or both with due regard to the safety of personnel and works and to the satisfaction of the Engineer.

The depth to which the excavation is to be carried out shall be as shown on the drawings, unless the type of material encountered is such as to require changes, in which case the depth shall be as ordered by the Engineer.

2.3.3 Dewatering and protection

Where water is met within excavation due to stream flow, seepage, springs, rain or other reasons, the Contractor shall take adequate measures such as bailing, pumping, constructing diversion channels, drainage channels, bunds, cofferdams and other necessary works to keep the foundation trenches dry when so required and to protect the green concrete/masonry against damage by erosion or sudden rising of water level. The methods to be adopted in this regard and other details thereof shall be left to the choice of the Contractor but subject to approval of the Engineer. Approval of the Engineer shall, however, not relieve the Contractor of the responsibility for the adequacy of dewatering and protection arrangements and for the quality and safety of the works.

Where cofferdams are required, these shall be carried out to adequate depths and heights, be safely designed and constructed and be made as watertight as is necessary for facilitating construction to be carried out inside them. The interior dimensions of the cofferdams shall be such as to give sufficient clearance for the construction and inspection and to permit installation of pumping machinery, etc. inside the enclosed area.

Pumping from the interior of any foundation enclosure shall be done in such a manner as to preclude the possibility of the movement of water through any fresh concrete. No pumping shall be permitted during the placing of concrete or for any period of at least 24 hours thereafter, unless it is done from a suitable sump separated from the concrete work by a watertight wall or other similar means.
At the discretion of the Contractor, cement grouting or other approved methods may be used to prevent or reduce seepage and to protect the excavation area. The Contractor shall take all precautions in diverting channels and in discharging the drained water as not to cause damage to the works, crops or any other property.

2.3.4 Preparation of foundation

The bottom of the foundation shall be levelled both longitudinally and transversely or stepped as directed by the Engineer. Before footing is laid, the surface shall be slightly watered and rammed. In the event of excavation having been made deeper than that shown on the drawings or as otherwise ordered by the Engineer, the extra depth shall be made up with concrete or masonry of the foundation grade at the cost of the Contractor. Ordinary filling shall not be used for the purpose to bring the foundation to level.

When rock or other hard strata is encountered, it shall be freed of all soft and loose material, cleaned and cut to a firm surface either level, stepped or serrated as directed by the Engineer. All seams shall be cleaned out and filled with cement mortar or grout to the satisfaction of the Engineer.

When foundation piles are used, the excavation of each pit shall be substantially completed before beginning pile-driving operations therein. After pile driving operations in a given pit are completed; all loose and displaced materials therein shall be removed to the elevation of the bottom of the footings.

2.3.5 Slips and blows

If there are any slips or blows in the excavation, these shall be removed by the Contractor at his own cost.

2.3.6 Public safety

Near towns, villages and all frequented places, trenches and foundation pits shall be securely fenced, provided-with proper caution signs and marked with red lights at night to avoid accidents. The Contractor shall take adequate protective measures to see that the excavation operations do not affect or damage adjoining structures.

2.3.7 Backfilling

Backfilling shall be done with approved material after concrete or masonry is fully set and carried out in such a way as not to cause undue thrust on any of the structure. All space between foundation masonry or concrete and the sides of excavation shall be refilled to the original surface, making due allowance for settlement, in 200 mm loose layers, which shall be watered and compacted.

2.3.8 Disposal of surplus excavated materials
Clause 1.4.7 above shall apply.

2.4 Precautions

All materials and labour required for fencing in and protecting against risk or accidents due to open excavation shall be provided by the Contractor.

2.5 Pumping

The Contractor shall arrange bailing out water in the foundations or trenches accumulated due to rains. The pumping out of water caused by springs, sub-soil water, canal or river seepage, and broken water mains or drains for which the Contractor is not responsible shall be arranged by the Department and the cost for the same is not included in the rate.

2.6 Rock Foundation

If rock foundation is secured, the excavation shall be done in such a manner as to allow the rock to be exposed and prepared for receiving the concrete or masonry. All loose and disintegrated rock or thin strata shall be stripped to a clean bed acceptable to the Engineer.

All seams or crevices shall be cleaned out and filled with concrete or mortar which shall be paid for separately.

2.7 Completion

The Contractor shall report in writing the completion of the foundation trenches to the Engineer, and no concrete or masonry may be commenced without that Officer's sanction in writing.

2.8 Measurements

Excavation for structures shall be measured in cubic metres for each class of material encountered, limited to the dimensions shown on the drawings or as directed by the Engineer. Excavation over increased width, cutting of slopes, shoring shuttering and planking shall be deemed as convenience for the Contractor in executing the work and shall not be measured and paid.

2.9 Rate

The rate includes all the operation as described in the items of work.

3. FILLING EXCAVATED EARTH IN FOUNDATION TRENCHES AND PLINTH OR UNDER FLOORS AND SAND FILLING IN PLINTH

3.1 Excavation in Earth Work and Filling

3.1.1 General
For excavation, reference may be made to specifications in section 1 and 2 above. The earth from cutting shall be directly used for filling and no claim for double handling of earth shall be entertained. Filling shall be done in regular horizontal layers each not exceeding 15 cm. in depth. Normally, excavated earth from same area shall be used for filling.

3.1.2 Earth
The earth used for filling shall be free from salts, roots, grass, rubbish or other foreign and organic matter. Lumps and clods exceeding 8 cms in any direction shall be broken or removed.

3.1.3 Filling Sides of Trenches
As soon as the work in foundation has been completed and measured, the sides of foundations shall be cleared of all debris, brick-bats, mortar droppings etc., and filled with earth in layers not exceeding 15 cms, each layer shall be adequately watered, rammed and consolidated before the succeeding one is laid. Earth shall be rammed with iron rammers where feasible, and with the butt ends crowbars where rammer cannot be used. No filling shall be commenced without the permission of the Engineer which must be obtained in writing.

3.1.4 Plinth Filling i.e. Filling under Floors
The plinth shall be similarly filled with earth in layers not exceeding 15 cms adequately watered and consolidated by ramming with iron or wooden rammer. When filling reaches the finished level, the surface shall be flooded with water for at least 24 hours, allowed to dry and then rammed and consolidated in order to avoid any settlement at a later stage. The finished level of filling shall be kept to slope intended to be given to the floor.

Where there is black cotton soil, this shall be removed to a depth of 60 cms as it is liable to absorb moisture and thus ruin a floor.

3.1.5 Measurements
Depth of consolidated earth fillings shall be measured for the purpose of payment. The dimensions of the filling shall be measured correct to the nearest cm and cubical contents worked out in cubic metres correct to two places of decimal.

3.1.6 Rate
The rate includes cost of all operations described above. This includes the excavation in earth work and filling in 15 cms layer, ramming, watering and consolidating upto a lead of 20 metres and lift upto 1.5 metres have been included in
the rates. Water charges, contractor’s profit @ 10% and over-head charges @ 5% have also been included in the rates.

3.2 Filling in Plinth with Sand under Floors including Watering, Ramming, Consolidating and Dressing Complete

Sand
Sand shall be clean and free from dust organic and foreign matter and corresponding to grading Zone V or IV.

Filling
Sand filling shall be done in a manner similar to earth filling as specified in 3.1.4 above. The surface of the consolidated sand shall be dressed to required level or slope. Concreting of floor shall not be started till the Engineer has inspected and approved the sand filling.

Measurements
Volume of consolidated filling shall be measured. The dimensions shall be measured correct to the nearest cm and cubical contents worked out in cubic metre correct to two places of decimal.

Rate
The rate includes cost of materials and labour involved in all operations described above. Carriage of material by mechanical transport upto one km and head load upto 100 mtrs has been included in the rates. In addition to this, water charges, contractor’s profit @ 10% and over-head charges @ 5% have also been included in the rates.

4. LEAD, LIFT, AND SURFACE DRESSING

4.1 Lead

4.1.1 Lead shall be measured from the centre of gravity of excavated earth. For measurements, the earth work proposed to be worked upon shall be demarcated in sections economically for placement of excavated earth. The mean lead shall be calculated separately for such sections.

4.1.2 The extra rates are applicable in different type of works for a lead of 20 metres or part thereof. The rates include contractor’s profit @ 10% and overhead charge @ 5%.

4.2 Lift

4.2.1 The lift shall be measured from centre of gravity of excavated earth to that of the placed earth. For such measurements, the earth work proposed to be worked upon shall be
demarcated in sections economically for placement of excavated earth. The mean lift shall be calculated separately for such sections.

For converting lift into horizontal lead, the lift up to 4 metres will be multiplied by 10 and from above 4 metres to 6 metres, it will be squared and then multiplied by 3.25 and beyond 6 metres it will be multiplied by 20.

When earth has to be carried over a spoil bank and dumped beyond it, the mean lift would be the difference in level between the centre of gravity of the excavated earth and top of the spoil bank omitting the dowel.

4.3 **Dressing**

4.3.1 Surface dressing shall include removing vegetation of cutting and filling up to depth of 25 cms. High portions of ground shall be cut down and, hollow and depression filled up to the required level with the excavated earth so as to give an even, neat and tidy look to the site. The cutting and filling shall be so balanced that no carriage of earth is involved either from or the site in question.

4.3.2 **Measurements**

The area of the ground dressed shall be measured in sqm. Length and breadth shall be measured correct to the nearest cm. Area shall be measured correct to two places of decimals.

4.3.3 **Rate**

The rate includes cost of labour involved in all the operations described above. This also includes 10% contractor's profit and 5% over-head charges.

5. **PLANKING AND STRUTTING FOR EARTH WORK IN EXCAVATION**

5.1 **General**

When the depth of trench in soft/loose soil exceeds 2 metres, stepping, sloping, or planking and strutting of sides shall be done. In case of loose and slushy soils, the depths at which these precautions are to be taken shall be determined by the Engineer according to the nature of soil.

Planking and strutting shall be 'close' or 'open' depending on the nature of soil and the depth of trench. The type of planking and strutting shall be determined by the Engineer. It shall be the responsibility of the Contractor to take all necessary steps to prevent the sides of trenches from collapse.

5.1.1 **Close planking and strutting**

Close planking and strutting shall be done by completely covering the sides of the trench, generally with short, upright, and members called 'poling boards.' These
shall be 250 x 38 mm in section or as directed by the Engineer. The boards shall generally be placed in position vertically in pairs, one board on either side of cutting. These shall be kept apart by horizontal walling of strong wood at a minimum spacing of 1.2 metres cross struttred with ballies or as directed by the Engineer.

The length and diameter of the ballie struts shall depend upon the width of the trench. Typical sketch of close timbering is given in Fig. 1. Where the soil is very soft and loose the boards shall be placed horizontally against the sides of the excavator and supported by vertical 'wallings' which shall be struttred to similar timber pieces on the opposite face of the trench. The lowest boards supporting the sides shall be taken in the ground for a minimum depth of 75mm. No portion of the vertical side of the trench shall remain exposed, so that the earth is not liable to ship out.

The withdrawal of the timbers shall be done very carefully to prevent collapse of the trench. It shall be started at one end and proceed systematically to the other end. Concrete or masonry shall not be damaged while removing the planks. No claim shall be entertained for any timber, which cannot be withdrawn and is lost or buried, unless required by the Engineer to be left permanently in position.

5.1.2 Open planking and strutting

In case of open planking and strutting, the entire surface of the side trench is not required to be covered. The vertical boards of 250 x 38 mm width shall be spaced sufficiently apart to leave unsupported strips of 50 cm average width. The detailed arrangement, sizes of the timber and the distances apart shall be subject to the approval of the Engineer. In all other respect, specifications for close planking and strutting shall apply to open planking and strutting. Typical sketch of open planking and strutting is given in Fig. 1.

5.1.3 Measurements

The dimensions shall be measured correct to the nearest cm and the area of the face supported shall be worked out in sqm correct to two places of decimal.

5.1.3.1 Work shall be grouped according to the following:
(a) Depth not exceeding 1.5 m.
(b) Depth exceeding 1.5 m in stages of 1.5m.

5.1.3.2 Planking and strutting to the following shall be measured separately:
(a) Trenches.
(b) Areas (the description shall include use and waste of raking shores).
(c) Shafts, walls, cesspits, manholes and the like.
(d) Where tightly driven close butt jointed sheeting is necessary as in case of running sand, the item shall be measured separately and packing of cavities behind sheeting with suitable material included with the item.

(e) Planking and strutting required to be left permanently in position shall be measured separately.

5.1.4 Rate
The rate shall include use and waste of all necessary timber work as mentioned above including fixing and subsequent removal.

5.1.5 Safety measures as detailed in Indian Standard Safety Code for excavation work (IS: 3764-1992 as amended from time to time) shall be adhered to.

5.1.6 Whenever there is disagreement between the Contractor and the Engineer regarding the necessity or otherwise of timbering or other safety measures, the Contractor shall be responsible to obtain the decision of the Engineer in writing, failing which the contractor shall be liable for the damages caused, due to non-adoption of proper timbering methods.

5.1.7 Poling Boards
These are used to support the sides of excavation in which the ground can stand upto a vertical phase of one metre or more. (Long enough to enable poling boards to be placed). Poling boards are short upright members of 250 x 38 mm section or as otherwise directed by the Engineer. The boards shall generally be placed in position vertically, in pairs one board on each side of cutting and shall be kept apart by horizontal walling of strong wood, at a minimum spacing of 1.2 metres cross strutted with bollies. The length of the bollie strut shall depend upon the width of the trench.

5.1.8 Horizontal strutting
In cases where the soil is found to be soft and loose or where the ground is heavily surcharged, the timber boards shall be placed horizontally against the sides of the excavation and supported by vertical wallings which in turn shall be strutted by cross bollies.

5.1.9 Runners

5.1.9.1 This type of timbering is used in bad ground which requires support during the whole period of excavation. These are driven down slightly in advance of the digging and the ends are kept 'toed in' to the bottom of the excavation to prevent loss of ground.

5.1.9.2 Runners are usually square edged but V-jointed runners are used to make tight job and to prevent as far as possible, the infiltration of water, silt etc. The lower ends shall be sharpened to a chisel edge and splayed.
5.1.9.3 If hard driving is anticipated the lower ends shall be iron. Shed and the heads shall be ringed or bound heads with hoop iron. Payment for each such item shall be made extra over the ordinary runner work (without iron shed end) described above.

5.1.10 Open timbering in trenches including use of and waste of all necessary timber work including walls, struts, open poling boards/horizontal sheeting/runners etc. as may be necessary and fixing and removal complete (measurements to be taken of the face area).

5.1.10.1 Open planking and strutting
This shall be as per Clause 5.1.2 above.

5.1.10.2 Measurements
The dimension shall be measured correct to the nearest cm and the area of the faces supported shall be worked out correct to two places of decimal in sqm. The type of timbering shall be clearly described in the bill of quantities. The area shall be measured for different depths as mentioned in the schedule.

Where tightly driven close butt jointed sheeting is necessary as in the case of running sand, the item shall be measured separately and the packing of cavities behind sheeting with suitable material shall be included in the description of the item.

5.1.10.3 Rate
The rate shall include use and waste of all necessary timber work as mentioned above including fixing and subsequent removing. The rate includes the cost of materials such as poling boards, walling ballies and struts etc. The carriage of material upto one km. by mechanical transport and upto 100 meters by head load has been included in the rates. Contractor's profit @ 10% and over-head charges @ 5% has been included in the rates.

5.1.11 Close timbering in trenches including use and waste of all necessary timber work including walls, struts, close poling board/horizontal sheeting/runner etc. as may be necessary shoring and packing cavities (Wherever required) and fixing and removal complete (measurements to be taken of the face area timbered).

5.1.11.1 Close planking and strutting
This shall be as per Clause 5.1.1 above.

5.1.11.2 Measurements
For measurements, specification 5.1.10.2 above shall be referred to.

5.1.11.3 Rate
For rates, specification 5.1.10.3 above shall be referred to.

6. REMOVAL OF SLIPS

6.1 Removal of slips in all kinds of soil (including saturated soil (including saturated soil but excluding boulder and rocky portion requiring blasting)).

6.1.1 In this case the serviceable material should be stacked at safe place so that it may not cause hindrance to traffic. The unserviceable material should be disposed of and a lead of 20 metres has been included in the rates. The rate includes removal of saturated soil also. Every effort should be made to remove as big boulders as is possible with manual labour and without resorting to blasting. For the removal of boulders and rocks, the help of crowbars must be taken. Where the crowbars are available in short supply at the site where the slips are to be removed, the uses of wooden poles have also been found out to be useful.

6.2 Removal of boulders or rocky portion of slips.

6.2.1 Wherever it is not possible to remove the boulders and rocks manually, blasting shall be resorted to. For carrying out the blasting, when permitted, reference may be made to relevant Chapter 7 - Earth Work. The rate includes removal of boulders or rocky portion up to a distance of 20 metres. Disposal of unserviceable materials stacking serviceable materials and neatly dressing the surface have been included in the rates.

6.3 Measurements

The cross-sections at suitable intervals as per the direction of the Engineer shall be plotted on the M.B.'s before actually removing the slips. Permanent pegs or bench marks may be fixed in order to plot the cross-sections. The slips should be measured in cubic metres. Convenient method may also be used in case of calculating the volumes of boulders and or rocks.

6.4 Rate

The rates include cost of all materials and equipment. The rates also include the labour involved in various operations for the removal of this item as mentioned in the schedule of rate. This also includes contractor's profit @ 10% and over-head charges @ 5%.

7. FORM WORK WITH STEEL PLATES AND TIMBER BATTENS, BALLIES ETC.

7.1 General

Form work shall include all temporary or permanent forms required for forming the concrete, together with all temporary construction required for their support.
Forms for concrete shall be constructed of timber, plywood or metal or PGI sheets and be of substantial and rigid construction true to shape and dimensions shown on the drawings. Where metal forms are used all bolts and rivets shall be counter sunk and well ground to provide smooth plain surface. Forms shall be so constructed as to be removable in sections in the desired sequence, without damaging the surface of concrete or disturbing other sections. For easy removal, bolted and wedged connection should be preferred to nailed joints. Wherever nailed joints are provided, just sufficient number of nails should be used and indiscriminate use of nails shall be avoided.

7.2 Materials

7.2.1 Timber, planks, scantlings and battens

Timber planks, scantlings and battens shall conform to specifications as given below.

7.2.1.1 Timber shall be of good quality and well-seasoned. It shall have uniform colour, reasonably straight grains and shall be free from dead knots, cracks, shakes, sapwood, heart-rot, sap rot boxed heart, pitch (resinous) pockets or streaks in exposed edges, worm holes, splits and wraps etc. Specified variety of timber shall be used in the work. Timber shall be sawn in direction of grains. Sawing should be truly straight and square. The timber for use in structures constantly in contact with water or damp earth shall be treated with suitable preservative laid down in IS: 401-2001 so as to resist fungi in termites and marine borers.

Timber consisting of sap-wood can also be used with the permission of the Engineer-in-Chief/Chief Engineer provided:

1) Its use is economical as compared to timber consisting of heart wood only and;
2) It is chemically impregnated with a suitable preservative as per recommended practice laid down in IS: 401-2001.

7.2.1.2 Kail Wood

7.2.1.2.1 1st Class Kail Wood
The timber shall be of very good quality, well-seasoned and free from defects such as dead knots, cracks, sapwood etc. No individual hard and sound knot shall exceed 6 sqcm in size and the aggregate area of such knots shall not be more than 1% of the area of the piece. There shall not be less than 5 growth rings per cm width in cross-section.

7.2.1.2.2 2nd Class Kail Wood
The timber shall be of good quality, well-seasoned and generally free from defect such as dead knots, cracks, shakes, sapwood etc. However, traces of sapwood shall be allowed. No individual sound and hard knot shall exceed 15 sqcm in size and the aggregate area of such knots shall not exceed 2% of the area of the piece. There shall not be less than 2 growth rings per cm width in cross-section.

The timber used in shuttering shall not be so dry as to absorb water from concrete and swell and bulge, nor, so green or wet as to shrink or wrap after erection. Kail wood or such other soft wood, which is not affected appreciably by its contact with water, shall be used. It shall be free from shakes, loose knots, wormholes or other defects. The planks, scantlings and battens shall be accurately sawn and planned on the side and the surface coming in contact with concrete. The dimensions of scantlings and battens shall conform to the design. The strength of the wood shall not be less than that assumed in the design.

7.2.1.3 Sal Wood

Sal is about 30 percent heavier than teak, 50 percent harder, and about 20 to 30 percent stronger. In shock resistance it is about 45 percent above teak. Its heart wood is a naturally durable wood, and usually remains immune to attack by white ants and fungi for a long period, while its sapwood is very perishable and should not be used. Well dried Sal is not a really easy wood to saw and work. It is a rough constructional wood than a carpentry timber. No individual hard and sound knot shall exceed 25 mm in diameter and the aggregate area of all the knots shall not exceed 1% of the area of the piece.

It can be used for a variety of purposes, such as for beams, rafters, flooring, piles, bridging, tool handles, picker arms and tent pegs etc.

7.2.2 Ballies

7.2.2.1 Ballies shall satisfy the requirements of IS specification No. 3337-1978. Ballies of various sizes and species of timber are extensively used for the construction of scaffolding and for the erection of temporary and semi-permanent structures. Ballies are also used in large quantities for fencing work, pile foundation, supports for shuttering and for flood protection works in the form of permeable spurs bank piling for preventing erosion. This standard has, therefore, been prepared with the object of providing guidance on the sizes and requirements of Ballies for general purposes.

7.2.2.2 Manufacture
Unless otherwise specified, the bark shall be completely removed and all branches and excrescences shall be dressed down flush with the surface. The top and bottom ends shall be cut square.

7.2.2.3 Requirements

Ballies shall be air-dried to a moisture content not exceeding 20 percent within a depth of 12 mm from the surface when measured at one-third length of the Ballies from its butt end.

Ballies shall be reasonably straight, and shall be free from cut across the grain, live insect attack, any kind of decay (rot), pronounced spiral or twisted grain, hollow heart and dead knots exceeding 5 cm in diameter.

7.2.2.4 The ballies shall be of Sal and of the variety popularly known as ‘gollas’. The diameter specified shall be the mean diameter. This mean diameter shall be the average of three diameters measured at the centre and the two ends. The following tolerances shall be permitted:

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Length</th>
<th>Mean diameter or diameter at the centre</th>
<th>Tolerances in diameter at the thinner end</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Ballies not exceeding 3 metres length.</td>
<td>Not less than the specified diameter.</td>
<td>The diameter at the thinner end shall not be less than specified diameter by more than 10 mm.</td>
</tr>
<tr>
<td>2.</td>
<td>Ballies exceeding 3 metres length.</td>
<td>Not less than the specified diameter.</td>
<td>The diameter at the thinner end shall not be less than specified diameter by more than 20 mm.</td>
</tr>
</tbody>
</table>

Ballies to be used as props shall have 100 mm minimum diameter, measured at mid length and 80 mm at thin end. Ballies shall be reasonably straight (the centre line joining any two points on the actual axis 3 meter apart shall not deviate from any point on the actual line of axis of the ballies by more than 50 mm in a length of 3m); and shall be free from cuts across the grain, large cracks, live insect attack, any kind of decay (rot) pronounced spiral or twisted grain, hollow heart and dead knots exceeding 50 mm in diameter. The top and bottom ends shall be cut square and shall be free from cracks.

For any further details on timber and ballie specifications, provisions of Chapter 2 of shall be followed.
7.2.3 P.G.I. Sheets

When the formwork with sheathing of steel sheets is to be done, it must be ensured that the minimum thickness of plain galvanized iron sheet is 1 mm. The steel sheets shall be placed on planks. In addition to planks, the battens etc. should also be provided to the satisfaction of Engineer. The battens should be horizontal well as vertical. The battens should be provided as per the design equipment. In case of vertical surface, the sheathing or iron sheets shall be adequately fixed. While fixing the sheathing with the planks, it must be ensured that head of the nails do not protrude above the plate. The steel plate sheet thickness shall be as specified in the Work item.

7.2.4 Oil for Forms

Unless some other form of oil is specified, refined pale paraffin mineral oil, raw linseed oil shall be used for wood forms. For steel forms the oil shall consist of refined mineral oil/raw linseed oil suitably compounded with one or more ingredients which are approved for the purpose.

7.2.5 Soap Solution for surface treatment

Soap solution for surface treatment of formwork shall be prepared by dissolving yellow soap in water to get the consistency of paint.

7.2.6 Nails

Mild Steel wire nails, shall be bright finished and of adequate strength. The type and size (length or designation) shall be as indicated or directed by the Engineer. Mild Steel wire nails shall conform to IS: 723-1972 Specification for Steel Countersunk Head Wire Nails (as amended from time to time).

7.2.7 Rope

Rope for use in formwork and centring shall consist of good quality munj ban or other equal and approved quality. It shall be new and stout.

7.3 Workmanship

7.3.1 Classification of Form Work

Formwork shall be classified depending upon the type of finish required for a particular work and will fall in any of the following four categories:

i) Formwork for Rough Finish: Formwork required to give a concrete surface which is either hidden from view or requires to be separately finished with plastering or rendering.
ii) Formwork for Fair Finish: Formwork required to give a concrete surface free from joint marks, honey combing etc. and is presentable without further treatment.

iii) Formwork for Medium Smooth Finish: Formwork required to give a concrete surface which may show some joint marks which may not be objectionable (on account of forming a pattern, by itself or otherwise not objectionable).

iv) Formwork for Textured or Decorative Fine Finish for Architectural Concrete: Formwork required to give a surface with a clear impression of lines according to the pattern specified by the Architect in the drawings, without requiring any treatment. This type of formwork will be further classified as under:
   a) Formwork with ordinary timber planking,
   b) Formwork with wrought timber i.e. sheathing having planed surface,
   c) Formwork with sheathing having tongued and grooved board/plywood lining/steel sheets, and
   d) Formwork with sheathing having special lining formed by providing formwork with smooth surface in bands of required sizes and at the required place as per the pattern specified in the architectural drawings.

7.3.2 General Requirements
7.3.2.1 The formwork shall be rigid and so constructed as to retain the shape and dimensions of the member being cast. It shall have sufficient strength and rigidity to withstand the load of concrete, and vibrations, movement of men, materials and plants and any other incidental loads without excessive deflection beyond permissible limits.

7.3.2.2 The formwork shall be so constructed as to be removable in sections by unscrewing or otherwise loosening them without hammering or levering with force. Only wedges, clamps, bolts or screws etc. shall be used in preference to nails or spikes. All side pieces shall be easily removable without disturbing the bottom pieces. Where however, use of nails and spikes become unavoidable, these shall be left projecting so that they can easily be withdrawn.

7.3.2.3 If at any stage of work during or after placing concrete in the structure, the formwork sags or bulges out beyond the required shape of the structure, the concrete shall be removed and work must be redone with fresh concrete and adequately rigid formwork at the cost of the Contractor. Details of shuttering and centring shall be subject to the approval of the Engineer.

7.3.3 Propping of Centring
7.3.3.1 The props shall consist of ballies or brick masonry pillars laid in mud mortar. Ballies shall be placed at a spacing of 1 to 1.2 metres and shall rest squarely on wooden sole plates of 40 mm thickness and with a minimum bearing area of 0.1 sq. metres. Double wedges shall be provided between the sole plate and the wooden prop so as to facilitate tightening and easing of shuttering without jarring the concrete. In case brick masonry pillars are used as props, the wooden sole plates shall be provided at the top of pillars and double wedges inserted between the sole plate and the bottom of shuttering.

7.3.3.2 In case of structures with two or more floors, the weight of concrete and centring and shuttering of any upper floor shall be suitably supported on at least two floors below the same. In such cases the props of upper floors must necessarily come over the props of the lower floors. The formwork and concreting of the upper floors shall not be done until the concrete of the lower floor has set for at least 14 days.

7.3.4 Shuttering

7.3.4.1 Shuttering shall be either of wooden planking of 38mm minimum thickness with or without steel sheet lining or of steel plates stiffened suitably by steel angles and would be such as to give the required type of finish on the surface. The shuttering shall have smooth and even surface and the joints shall not permit any leakage of cement grout or slurry.

7.3.4.2 Unless otherwise desired, all angles in concrete work shall be sharp and well defined. Where, however, a rounded edge, bevelled edge or moulding is required the provision shall be made in the form itself. Openings for fan clamps and other fittings connected with services shall be provided in the shuttering as directed by the Engineer.

7.3.4.3 Form lining shall be such as would not discolour the concrete nor would interfere with the normal chemical reaction of cement. When steel sheets are used for lining, the sheets shall be placed and mounted on the forms with minimum amount of kinks and other imperfections.

7.3.5 Surface treatment for shuttering

7.3.5.1 Forms shall be cleaned of all dust, wood shavings, dirt and other matter by washing with water. The process is facilitated by providing draining holes in the shuttering. The surface shall then be coated with soap solution applied before concreting is done. Soap solution for the purpose shall be prepared by dissolving yellow soap in water to get consistency of paint. Alternatively coats of raw linseed oil/refined pale paraffin mineral oil or form oil of approved manufacture may be applied. In case
steel shuttering is used, soap solution or raw linseed oil shall be applied after thoroughly cleaning the surface.

7.3.5.2 The oil or coating shall be applied with a brush or sprayed so as to cover the entire surface evenly. Care shall be taken that the coating, does not get on construction joint surfaces and reinforcement bars. It shall also not cause softening or permanent staining of concrete surface nor shall impede the wetting of surfaces to be water cured.

Special care shall be taken in case of small grooves. The form strips shall be oiled or coated thoroughly so as to prevent swelling of the forms and consequent damage to the concrete on removal of forms.

7.3.6 Camber
The shuttering for beams and slabs shall have camber of 4 mm per metre (1 in 250) or as directed by the Engineer, so as to offset the subsequent deflection. For cantilevers, the camber at free end, shall be 1/50th of the projected length or as directed by the Engineer.

7.3.7 Erection or Assemblage of Forms
Formwork shall be erected true to line, vertical or battered to proper slope as required and free from twist. It shall be so assembled as to facilitate easing and removal of the various parts in proper sequence without jarring the concrete. The completed form work shall be inspected and approved by the Engineer before placing reinforcement and laying concrete.

7.3.8 Ties
Metal rods or bolts are used as form-ties to hold the forms in position and to prevent bulging during concreting. Normally mild steel bolts are used varying in diameter from 10 mm to 20 mm, the smaller sizes being generally sufficient for bolts in direct tension in column and wall shuttering while the larger sizes are used for bolts subject principally to transverse loading. The threads of the bolts should be well-greased and any adhering concrete spillings cleaned from them as often as practicable. The diameter of holes through the timber should not be more than 1.5 mm greater than the diameter of the bolt. The bolts are removed when the forms are struck. Removal of bolts passing through set concrete can be made easier by well greasing the bolt or by giving the bolt half a turn while the concrete is only partly set. These bolts to be used as ties should be ordered in generous overall lengths with ample threaded length. Excess length can be readily taken up by packing and this enables us to use the bolts in any type of work. Sometimes wire ties are also used
but their use is restricted to such places where the concrete surface is to be covered by subsequent finishing materials as the ends of wire are liable to give objectionable rust stains if the concrete surface is left uncovered. The wire ties are drawn tight without exhibiting spring and are left in the concrete, the projecting ends being clipped off after removing shuttering. Wire ties are made of black annealed iron wire No. 9 to 16 gauge.

7.3.9 Spreader

7.3.9.1 Spreaders are provided in the forms to prevent the sides being forced in when the ties are tightened. There are many types of spreaders and most common of these are old fashioned wooden spreaders made by ripping of 25 mm boards. Wooden spreaders are removed as the concreting proceeds. Concrete spreaders are also quite common and these are cast in lengths equal to the thickness of wall, column or beam. They are usually 50 mm x 50 mm in cross-section and have a hole in the centre to allow the tie bolt to pass through. The advantage of these spreaders is that they need not be removed while the concreting proceeds and the removal of tie is very easy.

Where walls are subjected to water pressure on one side and are required to be water-tight, the ties are not removed and they are so provided that the clearance between their ends and the concrete surface is not less than 32 mm.

7.3.9.2 Arrangement of ties and spreaders

Different arrangements of ties and spreaders are shown in the sketches given in Fig. 2.

Type-I is the common form of threaded rod provided with a nut and plate at each end. Wooden spreader is used and the rod is entirely withdrawn from the wall when the forms are stripped.

Type-II shows a tie consisting of standard threaded rod provided with a nut and plate at each end like Type-I but with a concrete spreader.

Type-III shows a tie consisting of straight unthreaded pencil rod with "buttons" or clamps which are slipped over the rod and bear against walls. The clamps grip the rod by means of a set screw which puts a crimp in the rod to prevent the form from spreading. A wooden spreader is used with this kind of tie, which is removed as the concreting proceeds. The rods are entirely withdrawn from the wall when the form is struck.

Type-IV shows a tie consisting essentially of two lag screws which are removed from the wall when the forms are stripped and a part that remains in the wall into which
the lag screw are threaded. This inner part must be short enough so that no metal will remain closer than 40 mm of the outside wall surface when the lag screws are removed. A wooden spreader must be used with this tie which is withdrawn as the concreting proceeds. The holes left by the removal of lag screws are immediately rammed with suitable toothed reamers, so as to leave the surface of the holes clean and rough. The holes are then completely filled with mortar and the surface is finished to match the adjacent concrete.

7.3.10 Striking/Removal of Forms

Forms shall be removed gently. They shall be eased carefully in order to prevent the load being suddenly transferred to concrete. Form work shall not be struck and removed until the concrete has attained strength to take at least twice the stress to which concrete may be subjected at the time of removal. The period that shall elapse after the concrete has been laid and before easing and removal of centring and shuttering is undertaken shall be as follows:

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Part of structure</th>
<th>Periods*</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Slides of foundations, columns and walls.</td>
<td>48 hours</td>
</tr>
<tr>
<td>2.</td>
<td>Underside of slabs up to</td>
<td></td>
</tr>
<tr>
<td></td>
<td>a) 4.5 m span.</td>
<td>7 days</td>
</tr>
<tr>
<td></td>
<td>b) Over 4.5 m span.</td>
<td>14 days</td>
</tr>
<tr>
<td>3.</td>
<td>Under side of beam soffits and arches up to</td>
<td></td>
</tr>
<tr>
<td></td>
<td>a) 6 m span.</td>
<td>14 days</td>
</tr>
<tr>
<td></td>
<td>b) Over 6 m span &amp; upto 9 m.</td>
<td>21 days</td>
</tr>
<tr>
<td></td>
<td>c) Under side of beams and arches over 9 m.</td>
<td>28 days</td>
</tr>
<tr>
<td>4.</td>
<td>Domes, shells vaults, folded plates &amp; structures of special nature</td>
<td>As per written instructions of Engineer.</td>
</tr>
</tbody>
</table>

* This period is given for concrete work using Ordinary Portland Cement. For rapid hardening cement, a period equal to $3/7$ of the above period will be sufficient in all cases except vertical sides of slabs beams etc. in which case it shall be 24 hours. In case of frost or bad weather the periods may be suitably increased at the discretion of Engineer.
In slab and T-beam construction, sides shall be stripped first, then the underside of slab and lastly that of the beam.

In case of cantilever slabs and beams, centring shall remain till structures for counter acting or holding down have been erected and have attained sufficient strength.

The periods as mentioned in the above table are for normal weather conditions in plains when temperature is above 21°C (70°F). In cold weather conditions, when temperature is below 10°C (50°F), the above periods may be doubled. For a temperature of 10°C to 21°C (50°F to 70°F), the above periods may be increased proportionately.

For pre-stressed units the side forms shall be released as early as possible after 12 hours and soffit forms shall permit without restraint deformation of the member when pre-stress is applied.

All form work shall be removed without using any damage to the concrete. Centring shall be gradually and uniformly lowered in such a manner as to avoid any shock or vibrations. Supports shall be removed in such a manner as to permit the concrete to take stresses due to its own weight uniformly and gradually. Any work damaged through premature or careless removal of form shall be reconstructed at the cost of the Contractor.

The Engineer shall be informed in advance by the Contractor of his intention to strike any form work.

While fixing the time for form work, due consideration shall be given to the local conditions, character of the structure, weather and other conditions that influence setting of concrete and the materials used in the mix.

7.4 Measurements

Form work shall be measured as the area in square metres of shuttering in contact with concrete except in the case of inclined slab, and portion of curved shells requiring shuttering both on the underside and upper side in which case only area of underside shall be measured for payment. Dimensions shall be measured correct to a centimeter and areas shall be worked out correct to two decimal places.

No deductions shall be made for openings upto 0.4 m² in area.

Formwork to secondary beams shall be measured upto the sides of main beams but no deduction shall be made from the form work of the main beam at the intersection point. No deduction shall be made from the form work of a column at intersection of beams.
Where it is not specifically stated in the description of the item that formwork shall be paid for separately, the rate of R.C.C. items shall be deemed to include the cost of form work. Items involving height of propping and centring in excess of between supporting floor and ceiling shall be measured separately for different heights as under:

i) Height between 4 m to 5 m.
ii) Height between 5 m to 6 m.
iii) Height between 6 m to 7 m.

The edges of slabs and beams in floors and walls shall be measured in running metre correct to the nearest cm.

7.5 Rate

7.5.1 Unless otherwise stated, the labour rates include handling of all materials within 100 metres.

7.5.2 These rates are applicable for form work comprised of ordinary timber planking unplaned so as to give a rough finish. In case of planks are planed so as to give a medium smooth finish, the labour rates shall be increased by 3% and through rates shall also be increased corresponding to this increase in the labour rates. In case the timber planking having special lining is used so as to give the exposed concrete work the textured or decorative even surface for architectural purposes, the labour and through rates shall be increased by 5%. The increase of 3% to 5% is applicable only on the rates as per item No. 8.1 of the UKPWD Schedule.

7.5.3 The rates are applicable to all conditions of working and at all floors. Nothing extra shall be payable on account of extra lift of materials involved. The rates shall include the cost of materials and labour for various operations involved such as:

(a) Splayed edging and notching, allowances for overlaps and passing at angles, centring, shuttering, strutting, propping, bolting, nailing wedging, easing, striking and removal.

(b) Filleting.

(c) Dressing with oil.

(d) Raking or circular cutting.

7.5.4 (a) The rates are applicable for four metres height of propping and centring below supporting floor. For heights between 4 metres to 7 metres extra rates as per schedule shall be paid. These extra rates are exclusive of the cost of supporting brick/stone/C.C. Pillars if required at site. In case, these are used additional rates for these shall be paid after recovering the cost of salvaged materials.
In case the supporting brick/stone/C.C. pillars are required at site and extra rate for the same is to be given to the Contractor, then extra rates should be given for the net increase in height after deducting the height of the brick/stone/C.C. pillars. The provision of brick/stone/C.C pillars has not been taken into consideration upto a height of 4 metres, and these need not be constructed upto a height of 4 metres except otherwise the Engineer so directs.

(b) In case the supporting brick/stone/C.C. pillars are required at site and extra rate for the same is to be given to the Contractor, then extra rates should be given for the net increase in height after deducting the height of the brick/stone/C.C. pillars. The provision of brick/stone/C.C. pillars has not been taken into consideration upto a height of 4 metres, and these need not be constructed upto a height of 4 metres except otherwise the Engineer so directs.

7.5.5 The rates include carriage by mechanical transport upto 1 km, and head- load up to 100 metres.

7.5.6 The wastage at the time of fixing of centring/shuttering has been taken into consideration. Also the rates include the wastage on account of repeatedly usage of the material.

7.5.7 Where the inclination to horizontal plane exceeds 300 the shuttering must be provided on both underside and upper side, the area of the underside only shall be measured for payment. The rate includes the provision of shuttering of both sides.

7.5.8 In case of arches, the rate includes provision of fittings such as straps, bolts etc. and their carriage. The rate includes labour such as Carpenter, Beldar for assembling erection, dismantling and cleaning.

8. CONCRETE WORK

[Note: Latest IS Codes including any amendments shall be followed over and above the CPWD Specifications (Vol. I), 1990 and such code provisions shall supersede the following specifications, as applicable.]

8.1 Cement Concrete

8.1.1 General

These specifications cover the requirements of cement concrete for use in various components of structures.

For all items of concrete in any structural portion of the bridge or its components; controlled concrete shall be used unless otherwise specified when ordinary concrete of the mix shown on drawings or as directed by the Engineer may be used. These
specifications shall apply to cement concrete for ordinary structures and not for
dams or any other massive structures in which case the reference may be made to
separate specifications. The essentials to make a good concrete are listed briefly as
below:

i) Fresh cement and enough of it.

ii) Not too much mixing water.

iii) Clean, hard sand and stone.

iv) A proper balance between the amounts of sand and stone-not too much of
    either.

v) Carefully measured materials for each batch.

vi) Thorough mixing.

vii) Careful and uniform placing of concrete.

viii) Concrete kept damp or covered for several days.

8.1.2 Materials

8.1.2.1 Cement

The type of cement to be used shall be subject to the approval of Engineer and it
shall conform to specifications given below.

8.1.2.1.1 General

8.1.2.1.1.1 Unless otherwise specified cement shall conform to the following Indian Standard
    specifications:

(a) (i) Ordinary Portland cement, (ii) Rapid Hardening Portland Cement, and (iii) Low

(b) Portland blast furnace slag cement shall conform to IS: 455-1989.

(c) Portland Pozzolana cement shall conform to IS: 1489-1991.

(d) Masonry cement shall conform to IS: 3466-1988.

(e) White Portland cement shall conform to IS: 8042-1989.

8.1.2.1.2 Supply

The cement shall be packed in bags (of gunny, malt-ply paper of cloth) net weight of
each bag being 50 kg. Alternatively it may also be supplied at site in silos installed
for the purpose of supply.

8.1.2.1.3 Stacking and Storage

Cement shall be stored at the work site in such a manner as to prevent deterioration
due to moisture.
Cement shall be stored and stacked in bags in dry and water proof sheds. The bags shall be stacked at least 15 to 20 cm clear above the floors and 25 to 35 cm clear off the walls to prevent deterioration. Cement bags shall be kept free from the possibility of any dampness or moisture coming in contact with them. Cement shall be used in the order in which it is received. Each consignment of cement shall be stacked separately therein to permit easy access for inspection and facilitate removal. Cement bags shall not be stacked more than 12 bags high to avoid lumping up under pressure.

Storage of cement at site of work shall be at the Contractor's expense and risk in the event of any damage occurring to cement due to faulty storage or on account of negligence on his part. Such damage shall be the liability of the Contractor.

Where cement has been stored for over 6 months or for any reason the stored cement shows signs of deterioration or contamination, it shall be got tested before use, to ascertain its strength, setting time etc.

8.1.2.1.4 Limitation to use

The Contractor shall use all cement issued to him on the work for which it has been supplied. Cement surplus after the completion of the work shall not be disposed of without the previous consent of the Executive Engineer in writing.

8.1.2.1.5 Mode of Measurement

Cement shall be measured by weight in quintals, tonne/tons or in bags of 50 kg each, as the case may be.

8.1.2.1.6 Unless otherwise specified, 'cement' shall mean Ordinary Portland Cement for general use. Any type of cement which does not satisfy the conditions as per ISI Standards shall be rejected.

8.1.2.1.2 Classification

8.1.2.1.2.1 Portland Cement

8.1.2.1.2.1.1 Chemical Requirements

Ordinary and rapid hardening Portland cement shall comply with the following chemical requirements:

(a) Ratio of percentage of lime to percentages of silica, alumina, and iron oxide, when calculated by the formula:

\[
\frac{\text{CaO} - 0.7 \text{ SO}_3}{2.8 \text{ SiO}_2 + 1.2 \text{ Al}_2\text{O}_3 + 0.65 \text{ Fe}_2\text{O}_3}
\]

8.1.2.1.2.1.2 Additional Requirements

- Portland cement shall be non-hygroscopic in character as well as non-expanding and non-setting by itself.
: Not greater than 1.02 and not less than 0.66.
(b) Ratio of percentage of alumina to that of iron oxide: Not less than 0.66.
(c) Weight of insoluble residue: Not more than 1.5 percent.
(d) Weight of magnesia: Not more than 5 percent.
(e) Total sulphur content, calculated as sulphuric anhydride (SO3): Not more than 2.75 percent,
(f) Total loss on ignition: Not more than 4 percent.
Low heat Portland cement shall comply with the following requirements as to its chemical composition given below:
The percentage of lime after deduction of the amount necessary to combine with sulphuric anhydride present shall be not more than 2.4 times the percentage of silica plus 1.2 times the percentage of alumina and plus 0.65 times the percentage of iron oxide; nor be less than 1.9 times the percentage of silica, plus 1.2 times the percentage of alumina plus 0.65 times the percentage of iron oxide. In all other respects, low heat Portland cement shall comply with the requirements specified under item 8.1.2.1.2.1.1 (b), (c), (d), (e) and (f).

8.1.2.1.2.1.2 Physical Property Standards
(i) Soundness

Expansion by the “Le Chatelier” test not more than 100mm or 5mm after 7 days aeration, time of boiling being 3 hours. Alternatively autoclave expansion shall not be more than 0.5 percent when tested according to IS: 269-1989.

(ii) Setting Time

The setting time of the cements shall conform to the following requirements:

<table>
<thead>
<tr>
<th>Setting Time</th>
<th>Cement Type</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Ordinary (Minutes)</td>
</tr>
<tr>
<td>(a) Initial setting time not less than</td>
<td>30</td>
</tr>
<tr>
<td>(b) Final setting time not more than</td>
<td>600</td>
</tr>
</tbody>
</table>

(iii) Compressive Strength
The average compressive strength of at least three mortar cubes of the cement shall be as follows:

<table>
<thead>
<tr>
<th>Compressive Strength</th>
<th>Cement Type</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Ordinary (kg/sqcm)</td>
<td>Rapid Hardening (kg/sqcm)</td>
</tr>
<tr>
<td>(a) 1 day (24 hours) not less than</td>
<td>-</td>
<td>115</td>
</tr>
<tr>
<td>(b) 3 days (72 hours) not less than</td>
<td>115</td>
<td>210</td>
</tr>
<tr>
<td>(c) 7 days (168 hours) not less than</td>
<td>175</td>
<td>-</td>
</tr>
<tr>
<td>(d) 28 days (672 hours) not less than</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

(iv) Tensile strength

When requested by the purchaser at the time of placing the order, the average tensile strength of six mortar briquettes shall be as follows:

<table>
<thead>
<tr>
<th>Compressive Strength</th>
<th>Cement Type</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Ordinary (kg/sqcm)</td>
<td>Rapid Hardening (kg/sqcm)</td>
</tr>
<tr>
<td>(a) 1 day (24 hours) not less than</td>
<td>-</td>
<td>20</td>
</tr>
<tr>
<td>(b) 3 days (72 hours) not less than</td>
<td>20</td>
<td>30</td>
</tr>
<tr>
<td>(c) 7 days (168 hours) not less than</td>
<td>25</td>
<td>-</td>
</tr>
</tbody>
</table>

Cement shall not be rejected on the basis of tensile test above and no tensile strength test shall be required in case of low heat Portland cement.

(v) Heat of Hydration

The heat of hydration of low heat Portland cement shall be as follows:
8.1.2.1.2.2 Portland Pozzolana Cement

8.1.2.1.2.2.1 Manufacture
Portland pozzolana cement shall be manufactured either by intimately intergrinding together Portland cement clinker and pozzolana or by intimately and uniformly blinding Portland cement and fine pozzolana. Grinding method is easier and should be preferred. Where the blinding method is to be restored to due to certain reasons, care should be taken to that the blinding is as intimate as possible. The pozzolana constituent shall not exceed 25 percent by weight of the Portland cement.

8.1.2.1.2.2.2 Quality
Portland pozzolana cement shall conform to the relevant Indian Standard.

8.1.2.1.2.2.3 Uses
Portland pozzolana cement produces less heat of hydration and offers greater resistance to the attack of aggressive waters than normal Portland cement. Moreover it reduces the leaching of calcium hydroxide, liberated during the setting of cement. It is particularly useful in marine construction and mass concrete structures. While Portland pozzolana cement can generally be used wherever ordinary Portland cement is used, it is important to appreciate its limitation that the addition of pozzolana does not contribute to strength at early ages; only at later ages can one expect strengths similar to those for ordinary Portland cement.

8.1.2.1.2.3 White Cement
Thy grey colour of ordinary cement is due to the presence of an impurity of iron oxide in the raw materials, which do not contain iron oxide will be white. Contamination is also avoided during burning by using oil fuel instead of coal. The other properties of this cement are the same as those of ordinary cement. Coloured cements are prepared from white cement except in the case of red or brown cements which can be prepared from grey Portland cement. The grey or white cement is mixed with 5 to 10% of a suitable and chemically inert colouring pigment during the grinding process.

White cement is used as a rendering to give white appearance to concrete and plaster in buildings or other structures and also in white terrazzo flooring and dados. It is also necessary to use white Portland cement for the lighter shades of coloured concrete mortars and terrazzo flooring. The whiteness is secured by reducing the iron oxide to a minimum.

(a) 7 days – not more than 65 calories per gram.
(b) 28 days – not more than 75 calories per gram.
8.1.2.2 Aggregate

*Coarse aggregates of nominal size as specified and used for each item shall conform to specifications given below.*

8.1.2.2.1 Aggregates

8.1.2.2.1.1 Description and Physical Characteristics of Aggregates

8.1.2.2.1.1.1 General

To enable detailed reports on aggregates to be framed on a comparable basis, the following general headings under which the appropriate information may be given are suggested as a guide:

(a) Trade Group: For example, granite, lime stone and sand stone.

(b) Petrological Name & Description: The correct petrological name should be used and should be accompanied by a brief description of such properties as hardness, colour, grain, imperfections etc.

(c) Description of the Bulk: The degree of cleanliness, that is, freedom from dust should be stated and reference made to the presence of any pieces not representative or the bulk, such as elongated or flaky pieces.

(d) Particle Shape.

(e) Surface Texture.

8.1.2.2.1.1.2 Nomenclature of Rock

The technical nomenclature of rocks is an extensive one and for practical purposes it is sufficient to group together with those rocks having certain petrological characteristics in common. Accordingly, the list of trade groups given is adopted for the convenience of producers and users of stone.

8.1.2.2.1.1.3 Trade Groups of Rocks used as Aggregates

Name of trade-groups: Granite, Gabbro, Aplite, Dolerite, Rhyolite, Basalt, Sand stone, Lime Stone, Granulite, Gneiss, Schist and Marble.

8.1.2.2.1.1.4 List of Rocks placed under the appropriate Trade Groups

The correct indentification of a rock and its placing under appropriate trade-group shall be left to the decision of the Geological Survey of India or any competent geologist.

**Igneous Rocks**

<table>
<thead>
<tr>
<th>Granite Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Granite</td>
</tr>
<tr>
<td>Granophyre</td>
</tr>
<tr>
<td>Synite</td>
</tr>
</tbody>
</table>
8.1.2.2.1.1.5 Particle Shape and Surface Texture

(i) The external characteristics of any mixture or mineral aggregate include a wide variety of physical shape, colour and surface condition. In order to avoid lengthy descriptions, it may be convenient to apply to distinctive group types of aggregates some general term which could be adopted.

| Gabbro Group  |  |
|---------------|  |
| Gabbro        | Peridotite |
| Norite        | Pyroxenite |
| Anorthosite   | Epidiorite |

<table>
<thead>
<tr>
<th>Aplite Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aplite</td>
</tr>
<tr>
<td>Porphyry</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Dolerite Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dolerite</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Rhyolite Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rhyolite</td>
</tr>
<tr>
<td>Trachyte</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Basalt Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Andesite</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sedimentary Rocks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sand Stone Group</td>
</tr>
<tr>
<td>Sand Stone</td>
</tr>
<tr>
<td>Quartzite</td>
</tr>
<tr>
<td>Grit</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Lime Stone Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lime Stone</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Metamorphic Rocks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Granulite and Gneiss Groups</td>
</tr>
<tr>
<td>Granite Gneiss</td>
</tr>
<tr>
<td>Composite Gneiss</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Schist Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Slate</td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Marble Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Marble</td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>
(ii) The simple system shown in tables below has, therefore, been devised and is put forward in the hope that it will facilitate defining the essential features of both particle shape and surface characteristics.

<table>
<thead>
<tr>
<th>Classification</th>
<th>Description</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Round</td>
<td>Fully water borne or completely shaped by attrition.</td>
<td>River or seashore gravels, desert, seashore and windblown sands.</td>
</tr>
<tr>
<td>Irregular or partly rounded</td>
<td>Naturally irregular, or partly shape by attrition, and having rounded edges.</td>
<td>Pit-sands and gravels; land or dug flints; cuboid rock.</td>
</tr>
<tr>
<td>Angular</td>
<td>Possessing well-defined edges formed at the intersection of roughly planar surfaces.</td>
<td>Crushed rocks of all types; talus; screed.</td>
</tr>
<tr>
<td>Flaky</td>
<td>Material, usually angular, of which the thickness is small relative to the width and/or length.</td>
<td>Laminated rocks.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Group Surface Texture</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Glassy</td>
<td>Black flint.</td>
</tr>
<tr>
<td>2.</td>
<td>Smooth</td>
<td>Cherty, slate, marble, some rhyolite.</td>
</tr>
<tr>
<td>5.</td>
<td>Honey combed and porous</td>
<td>Scoriae, pumice, tress.</td>
</tr>
</tbody>
</table>

(iii) Surface characteristics have been classified under five headings or groups. The grouping is broad and is not supposed to be a precise petrographical classification, but is based upon a visual examination of hand specimens. With certain materials, however, it may be necessary to use a combined description with more than one group-number for an adequate description of the surface texture, for example, crushed gravel 1 and 2, colitis 3 and 5.
Section 6 - Works Requirements

8.1.2.2.1.2 Crushed Stones (One size)

8.1.2.2.1.2.1 Scope

This standard covers the requirements for aggregates, crushed or uncrushed, derived from natural sources, such as river terraces and river beds, glacial deposits, rocks boulders and gravels, for use in the production of concrete for normal structural purposes including mass concrete works, road works etc.

8.1.2.2.1.2.2 General

Aggregate most of which is retained on 4.75 mm I.S. Sieve and containing only as much final material as is permitted for the different types is described as coarse aggregates. This shall be broken from hard stone obtained from the approved quarry. The quarry shall be approved by the Executive Engineer. The aggregates shall be hard, strong, dense, durable clean, free from veins, adherent coatings, injurious amounts of disintegrated pieces, alkali, vegetable matter and other deleterious substances. As far as possible, flaky, scoriaceous and elongated pieces shall be avoided. It shall also be free from soft, friable, thin, elongated or laminated pieces and shall be roughly cubical in shape. It shall be clear from dirt. If coarse aggregates contain more than the prescribed limits of clay or mud etc., it shall be properly washed and dried before mixing with other ingredients to make concrete.

8.1.2.2.1.2.3 Deleterious Materials

Coarse aggregates shall not contain any harmful material such as iron pyrites, coal, mica, shale or similar laminated material, clay, alkali, soft fragments, sea shells, organic impurities etc., in such quantities so as to adversely affect the strength and durability of concrete. In addition to above in reinforced concrete, the aggregate shall not contain any material which might attack the reinforcement. The maximum quantities of deleterious materials in the coarse aggregate, when determined in accordance with IS: 2386-1963 (Part 2) “Method of test for Aggregates for Concrete”, shall not exceed the limits (Percentage by weight) laid down in the following table. However, the Engineer, at his discretion, may relax some of the limits as a result of some further tests and evidence of satisfactory performance of the aggregates.

### Limits of Deleterious Materials

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Deleterious Substance</th>
<th>Method of Test</th>
<th>Fine Aggregate (%age by Weight – Max.)</th>
<th>Coarse Aggregate (%age by Weight – Max.)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Uncrushed</td>
<td>Crushed</td>
</tr>
<tr>
<td>1</td>
<td></td>
<td>2</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>
## Deleterious Substance Method of Test

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Deleterious Substance</th>
<th>Method of Test</th>
<th>Fine Aggregate (%age by Weight – Max.)</th>
<th>Coarse Aggregate (%age by Weight – Max.)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Uncrushed</td>
<td>Crushed</td>
</tr>
<tr>
<td>1</td>
<td></td>
<td></td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>(i)</td>
<td>Coal &amp; lignite</td>
<td>IS: 2386 (Part 2)-1963</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>(ii)</td>
<td>Clay lumps</td>
<td>-do-</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>(iii)</td>
<td>Materials finer than Sieve 75 micron</td>
<td>IS: 2386 (Part 1)-1963</td>
<td>3.00</td>
<td>15.00</td>
</tr>
<tr>
<td>(iv)</td>
<td>Soft fragments</td>
<td>IS: 2386 (Part 2)-1963</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>(v)</td>
<td>Shale</td>
<td>-do-</td>
<td>1.00</td>
<td>-</td>
</tr>
<tr>
<td>(vi)</td>
<td>Total of percentages of all deleterious materials (except mica) including S. No. (i) to (v) for Col. 4, 6 &amp; 7 and S. No. (i) and (ii) for Col. 5 only.</td>
<td></td>
<td>5.00</td>
<td>2.00</td>
</tr>
</tbody>
</table>

**Note 1:** The presence of mica in the fine aggregate has been found to reduce considerably the durability and compressive strength of concrete and further investigations are underway to determine the extent of the deleterious effect of mica. It is, advisable, to investigate the mica content of fine aggregate and make suitable allowances for the possible reduction in the strength of concrete of mortar.

**Note 2:** The aggregate shall not contain harmful organic impurities (tested in accordance with IS: 2386 (Part 2)-1963 in sufficient quantities to affect adversely the strength and durability of concrete. A fine aggregate which fails in the test for organic impurities may be used, provided that when tested for the effect of organic impurities on the strength of mortar, the relative strength at 7 and 28 days in accordance with 7 of IS: 2386 (Part 6)-1963 is not less than 95 percent.

### 8.1.2.2.1.2.4 Aggregate Crushing Value

The aggregate crushing value, when determined in accordance with IS: 2386 (Part 4)-1963, shall not exceed 45 percent for aggregate used for concrete other than for wearing surfaces, and 30 percent for concrete for wearing surfaces, such as runways, roads and pavements.

### 8.1.2.2.1.2.5 Aggregate Impact Value
As an alternative, the aggregate impact value may be determined in accordance with the method specified in IS: 2386 (Part 4)-1963. The aggregate impact value shall not exceed 45 percent by weight for aggregates used for concrete other than for wearing surfaces and 30 percent by weight for concrete for wearing surfaces, such as runways, roads and pavements.

8.1.2.2.1.2.6 Aggregate Abrasion Value

Unless otherwise agreed to between the purchaser and the supplier the abrasion value of aggregates, when tested in accordance with the method specified in IS: 2386 (Part 4)- 1963 using Los Angeles machine, shall not exceed the following values:

<table>
<thead>
<tr>
<th></th>
<th>For aggregates to be used in concrete for wearing surfaces.</th>
<th>30 percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a)</td>
<td>For aggregates to be used in other concrete.</td>
<td>50 percent</td>
</tr>
</tbody>
</table>

8.1.2.2.1.2.7 Soundness of Aggregate

For concrete liable to be exposed to the action of frost, coarse and fine aggregates shall pass a sodium or magnesium sulphate accelerated soundness test specified in IS : 2386 (Part 5)-1963, the limits being set by agreement between the purchaser and the supplier, except that aggregates failing in the accelerated soundness test may be used if they pass a specified freezing and thawing test satisfactory to the user.

8.1.2.2.1.2.8 Size and Grading of Aggregates

The coarse aggregates shall be supplied in the nominal size as given in the tables below.

### Coarse Aggregates

<table>
<thead>
<tr>
<th>I.S. Sieve Designation</th>
<th>Percentage Passing for Single-sized Aggregate of Nominal Size</th>
<th>Percentage Passing for Graded Aggregate of Nominal size</th>
</tr>
</thead>
<tbody>
<tr>
<td>63 mm</td>
<td>60 mm 40 mm 20 mm 16 mm 12.5 mm 10 mm 40 mm 20 mm 16 mm 12.5 mm</td>
<td></td>
</tr>
<tr>
<td>1 80 mm 100 - - - - - - - - -</td>
<td></td>
<td></td>
</tr>
<tr>
<td>63 mm 85 to 100 100 - - - - - - - - -</td>
<td></td>
<td></td>
</tr>
<tr>
<td>40 mm 0 to 30 85 to 100 100 - - - - 95 to 100 100 - -</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20 mm 0 to 5 0 to 85 to 100 - - - - 30 to 95 to 100 100 100</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I.S. Sieve Designation</td>
<td>Percentage Passing for Single-sized Aggregate of Nominal Size</td>
<td>Percentage Passing for Graded Aggregate of Nominal Size</td>
</tr>
<tr>
<td>------------------------</td>
<td>-------------------------------------------------------------</td>
<td>----------------------------------------------------------</td>
</tr>
<tr>
<td></td>
<td>63 mm</td>
<td>40 mm</td>
</tr>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>16 mm</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>12.5 mm</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>10 mm</td>
<td>0 to 5</td>
<td>0 to 5</td>
</tr>
<tr>
<td>4.75 mm</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>
Coarse Aggregates for Mass Concrete
The following aggregates for mass concrete works shall be in the size as per the following table:

<table>
<thead>
<tr>
<th>Class &amp; Size</th>
<th>I.S. Sieve Designation</th>
<th>Percentage Passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very Large, 150 to 80 mm</td>
<td>150 mm</td>
<td>90 to 100</td>
</tr>
<tr>
<td></td>
<td>80 mm</td>
<td>0 to 10</td>
</tr>
<tr>
<td>Large, 80 to 40 mm</td>
<td>80 mm</td>
<td>90 to 100</td>
</tr>
<tr>
<td></td>
<td>40 mm</td>
<td>0 to 10</td>
</tr>
<tr>
<td>Medium, 40 to 20 mm</td>
<td>40 mm</td>
<td>90 to 100</td>
</tr>
<tr>
<td></td>
<td>20 mm</td>
<td>0 to 10</td>
</tr>
<tr>
<td>Small, 20 to 4.75 mm</td>
<td>20 mm</td>
<td>90 to 100</td>
</tr>
<tr>
<td></td>
<td>4.75 mm</td>
<td>0 to 10</td>
</tr>
<tr>
<td></td>
<td>2.36 mm</td>
<td>0 to 2</td>
</tr>
</tbody>
</table>

8.1.2.2.1.2.9 When coarse aggregates brought to the site is ungraded, single size coarse aggregates of different nominal size shall be mixed at site with other ingredients of concrete, either directly in the mixture or on the platform in the proportion indicated in the following table:

<table>
<thead>
<tr>
<th>Cement concrete mixture</th>
<th>Nominal size of graded aggregate required (mm)</th>
<th>Part of single size aggregate of sizes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>50 mm</td>
</tr>
<tr>
<td>1:6:12</td>
<td>63</td>
<td>9</td>
</tr>
<tr>
<td>1:6:12</td>
<td>40</td>
<td>-</td>
</tr>
<tr>
<td>1:5:10</td>
<td>63</td>
<td>7.5</td>
</tr>
<tr>
<td>1:5:10</td>
<td>40</td>
<td>-</td>
</tr>
<tr>
<td>1:4:8</td>
<td>63</td>
<td>6</td>
</tr>
<tr>
<td>1:4:8</td>
<td>40</td>
<td>-</td>
</tr>
<tr>
<td>1:3:6</td>
<td>63</td>
<td>4.5</td>
</tr>
<tr>
<td>1:3:6</td>
<td>20</td>
<td>-</td>
</tr>
<tr>
<td>1:2:4</td>
<td>40</td>
<td>-</td>
</tr>
<tr>
<td>1:2:4</td>
<td>20</td>
<td>-</td>
</tr>
<tr>
<td>1:2:4</td>
<td>12.5</td>
<td>-</td>
</tr>
<tr>
<td>1:1-1/2:3</td>
<td>20</td>
<td>-</td>
</tr>
</tbody>
</table>

Note: The proportions indicated in table above are by volume. When considered necessary, these proportions may be varied marginally by Engineer after making sieve analysis of aggregate brought to site for obtaining required graded aggregate. No adjustments in rates shall be made for any variations in the proportions so ordered by the Engineer. If single size coarse aggregates are not premixed at site to obtain the graded coarse aggregate required
for the mix, the volume of single size aggregates shall be suitably increased to account for reduction in total volume at the site of mixing.

8.1.2.2.1.2.10 Supply

The coarse aggregates proposed to be used for the concrete work shall be got approved from the Engineer before the start of the work. All subsequent supplies shall preferably be obtained from the same source.

8.1.2.2.1.2.11 Stacking

Only the aggregates, satisfying the specification requirements, shall be conveyed to the roadside and stacked. Each size of aggregate shall be stacked separately. Likewise, materials obtained from different quarry sources shall be stacked separately in locations not liable to inundation or floods.

The dimensions of the stacks and their location shall be as approved by the Engineer. Where the material is improperly stacked, the Engineer shall have the right to order complete re-stacking of the materials to specifications at the cost of the Contractor.

Mineral filler shall be supplied in dry state in bags or other suitable containers approved by the Engineer and shall be protected from weather, dampness, etc., so as to prevent deterioration in quality.

The coarse aggregates shall be supplied at site in regular stacks as mentioned below:

<table>
<thead>
<tr>
<th>Size of stack (in meters)</th>
<th>Length</th>
<th>Breadth</th>
<th>Height</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2.0</td>
<td>2.0</td>
<td>0.50</td>
</tr>
<tr>
<td>or 5.0</td>
<td>5.0</td>
<td>1.50</td>
<td></td>
</tr>
</tbody>
</table>

8.1.2.2.1.2.12 Storage

The materials shall be stored so as to prevent contamination and stagnation. If stored in piles on ground, the aggregate shall not be dumped on loam, mud or grass so that, on re-handling, dirt and rubbish are not carried to the concrete. If a clear and hard surface is not available, a platform of planks or a floor of bricks shall be prepared to receive the aggregates.

The aggregates shall be stored in such a way as to prevent admixture of foreign materials. Different sizes of fine or coarse aggregates shall be stored in separate stock-piles sufficiently away from each other to prevent intermixing of the materials at the edges of the piles.
8.1.2.2.1.2.13 Measurements

Coarse and fine aggregates supplied at site of works shall be paid for in cubic metres. The actual volume of the aggregates to be paid for shall be computed after deducting the following percentages from the volume computed by stack measurements:

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Standard size of aggregates</th>
<th>Percentage reduction in volume computed by stack measurements to arrive at the volume to be paid for</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>75 mm and 63 mm</td>
<td>12.5</td>
</tr>
<tr>
<td>2.</td>
<td>40 mm and 25 mm</td>
<td>10</td>
</tr>
<tr>
<td>3.</td>
<td>20 mm, 12 mm, 10 mm &amp; 6 mm</td>
<td>5</td>
</tr>
<tr>
<td>4.</td>
<td>Fine aggregate</td>
<td>Nil</td>
</tr>
</tbody>
</table>

Unless otherwise directed, measurements shall not be taken until sufficient material for use on the road have been collected and stacked. Immediately after measurement, the stacks shall be marked by whitewash or other means as directed by the Engineer.

8.1.2.2.1.3 All-in-Aggregates

8.1.2.2.1.3.1 General

For all common properties it shall conform to “Coarse Aggregate”. All-in-aggregate shall be composed of fine and coarse aggregates collected directly from pit, river bed or crushing plants.

8.1.2.2.1.3.2 Grading of all-in-aggregates

If combined aggregate containing both fine and coarse aggregate are available, these need not to be separated into fine and coarse but necessary adjustments shall be made in the grading by addition of single-sized aggregates/fine aggregates to obtain the specified grading. For 40 mm and 20 mm nominal size of all-in-aggregate, the final grading shall be as under:

<table>
<thead>
<tr>
<th>I.S. Sieve Designation</th>
<th>Percentage passing for all-in-aggregate of:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>40 mm nominal size</td>
</tr>
<tr>
<td>80 mm</td>
<td>100</td>
</tr>
<tr>
<td>40 mm</td>
<td>95 to 100</td>
</tr>
<tr>
<td>20 mm</td>
<td>45 to 75</td>
</tr>
<tr>
<td>4.75 mm</td>
<td>25 to 45</td>
</tr>
<tr>
<td>600 micron</td>
<td>8 to 30</td>
</tr>
</tbody>
</table>
### 8.1.2.2.1.3.3 Sample

Samples of all-in-aggregate proposed to be used for the concrete work shall be got approved from the Engineer before the start of work. All subsequent supplies shall preferably be obtained from the same source.

Note: All-in-aggregate is not recommended to be used in reinforced concrete work, as the grading is liable to vary and the wide range of sizes increases rate of segregation.

#### 8.1.2.2.1.4 Water-Borne Stone aggregate (One Size)

Same as under section 8.1.2.2.1.2 above.

*The fine aggregate used shall conform to specifications given below.*

#### 8.1.2.2 Sand

For Plasters, sand shall be used as per IS: 1542-1992, and for Masonry mortars the sand shall be used as per IS: 2116-1980, and sand of fine aggregate for Cement Concrete Work shall conform to IS: 383-1970. The quarry from which the sand is obtained shall be subject to the approval of the Executive Engineer.

**8.1.2.2.2.1 General**

Natural sand is found as a result of disintegration of rock, which is deposited by stream or glacial agencies. Sand may be obtained either from river bed or from pits. Sand consists of cohesionless aggregates of rounded, sub-rounded, angular, sub-angular, or flat fragments of more or less unaltered rocks or minerals, 90 per cent of the particles being greater than 0.06 mm and less than 2 mm in size.

Sand which contains 90% of particles of size greater than 0.06 mm and less than 0.2 mm is fine sand.

Sand which contains 90% of particles of size greater than 0.6 mm and less than 2 mm is coarse sand.

**8.1.2.2.2.1.1 Qualities of Sand**

Sand shall be hard, durable, clean and free from adherent coatings and organic matter and shall not contain any appreciable amount of clay balls or pallets. Sand shall not contain harmful impurities such as iron pyrites, coal particles, lignite, mica, shale or similar laminated material, alkali and organic impurities in such form or quantities as to affect the strength or durability of concrete or mortar. Sand to be

<table>
<thead>
<tr>
<th>I.S. Sieve Designation</th>
<th>Percentage passing for all-in-aggregate of:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>40 mm nominal size</td>
</tr>
<tr>
<td>150 micron</td>
<td>0 to 6</td>
</tr>
</tbody>
</table>
used for places where reinforcement is used shall not contain any material liable to
attack the steel reinforcement.

8.1.2.2.1.2 Sand for Mortars

In addition to the requirements given in the foregoing Clause 8.1.2.2.1.1 unless
otherwise specified by the Engineer, the maximum quantities of silt, in sand not
exceed the following limits, determined by field test with measuring cylinder - 8%.

8.1.2.2.1.3 Grading of Coarse Sand

The grading of coarse sand shall be within the limits specified below:

<table>
<thead>
<tr>
<th>I.S. Sieve Designation (IS: 460-1985)</th>
<th>Percentage by Weight Passing I.S. Sieve</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.75 mm</td>
<td>100</td>
</tr>
<tr>
<td>2.36 mm</td>
<td>90 – 100</td>
</tr>
<tr>
<td>1.18 mm</td>
<td>70 – 100</td>
</tr>
<tr>
<td>600 micron</td>
<td>30 – 100</td>
</tr>
<tr>
<td>300 micron</td>
<td>5 – 70</td>
</tr>
<tr>
<td>150 micron</td>
<td>0 – 15</td>
</tr>
</tbody>
</table>

Sand whose grading falls outside the above limits due to excess or deficiency of
course or fine particles shall be processed to comply with the standard by screening
through a suitably sized sieve and/or blending with required quantities of suitable
size of sand particles.

8.1.2.2.2 Fine Sand for Mortars

8.1.2.2.2.1 General

Where coarse sand is not available or where its cost is prohibitive, fine sand, not
conforming to the specifications of sand as given above, may be used if so specified
by the Engineer after ascertaining the strength and suitability of mortar prepared out
of fine sand. (Such detailed provision shall be clearly indicated in the general
specifications in the tender documents.)

8.1.2.2.2.2 Qualities of Fine Sand

Fine sand shall be obtained from river beds not affected by tidal waters of the sea
and shall be clean, sharp and free from excessive deleterious matter. The sand shall
not contain more than 8 percent of mud and silt as determined by field test with a
measuring cylinder. The method of determining silt content is given below:

A sample of sand to be tested shall be placed without drying in a 200 ml measuring
cylinder. The size of sample shall be such that it fills the cylinder upto the 100 ml mark.
Clean water shall be added up to 150 ml mark. The mixture shall then be shaken vigorously and the contents allowed to settle for 3 hours. The height of the silt visible as settled layer above the sand shall be expressed as percentage of the height of the sand below. The sand containing more than the above allowable percentage of silt shall be washed so as to bring the silt contents within the allowable limits.

8.1.2.2.2.2.3 Fineness Modulus of Coarse/Fine Sand

This shall not be less than 2.5 and 1 (respectively for coarse fine sand as determined by the following method:

The fineness modulus of sand shall be determined by taking 500 grams of it from representative sample of sand and passing it successively through the six Indian Standard sieves No. 4.75 mm, 2.36 mm, 1.18 mm, No. 600 microns, 300 microns and No. 150 microns. The percentage of sand retained on each sieve successively shall be noted and the cumulated percentage retained on each sieve computed. The total of cumulative percentages retained on the six sieves divided by 100 shall give the fineness modulus of sand. The following example illustrates the computation of fineness modulus of a sample of sand:

<table>
<thead>
<tr>
<th>Sieve description as per I.S.</th>
<th>Percentage retained on each sieve respectively</th>
<th>Cumulative Percentage retained on successive sieves</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.75 mm</td>
<td>0</td>
<td>-</td>
</tr>
<tr>
<td>2.36 mm</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>1.18 mm</td>
<td>10.5</td>
<td>11.5</td>
</tr>
<tr>
<td>600 microns</td>
<td>49.0</td>
<td>60.5</td>
</tr>
<tr>
<td>300 microns</td>
<td>33.5</td>
<td>94.0</td>
</tr>
<tr>
<td>150 microns</td>
<td>5.0</td>
<td>99.0</td>
</tr>
<tr>
<td>Pan</td>
<td>1.0</td>
<td>266.0</td>
</tr>
<tr>
<td>Total</td>
<td>100.0</td>
<td>266.0</td>
</tr>
</tbody>
</table>

\[
\text{Fineness Modulus} = \frac{266.0}{100.0} = 2.66
\]

8.1.2.2.3 Bulking of Sand

In the nominal mortar mixes specified by volume sand is assumed to be dry. Dry and saturated sand almost have the same volume but damp sand increases in volume (Bulking), depending upon moisture content. Due allowance for bulking of sand shall
be made while preparing the mortar mixes based on volume measurements the actual amount of bulking varies with the grading of the sand. Bulkage of sand shall be determined by the methods prescribed below.

**Bulking of Fine aggregate Sand (Field Methods)**

Two methods are suggested for, determining the bulking of sand/fine aggregate. The procedure may be suitably varied, if necessary. Both depend on the fact that the volume of inundated sand/fine aggregate is the same if the sand/fine aggregate were dry.

**Method 1:** Put sufficient quantity of sand loosely into a container until it is about two third full. Level off the top of the sand and pushing a steel rule vertically down through the and at the middle to the bottom, measure the height. Suppose this is 'X' cm,

Empty the sand out of the container into another container where none of it is lost. Half fill the first container with water. Put back about half the sand and rod it with a steel rod, about 6 mm in diameter, so that its volume is reduced to a minimum, Then add the remainder and level the top surface of the inundated sand. Measure its depth at the middle with the steel rule. Suppose this is 'Y' cm.

The percentage of bulking of the sand due to moisture shall be calculated from the formula:

\[
\text{Percentage bulking} = \left( \frac{X}{Y} - 1 \right) \times 100
\]

**Method 2:** In a 250 ml measuring cylinder pour (consolidated by staking) until it reaches the 200 ml mark.

Then fill the cylinder with water and stir the sand well (the water shall be sufficient to submerge the sand completely). It will be seen that the sand surface is now below its original level. Suppose the surface is at the mark 'Y' ml, the percentage of bulking of sand due to moisture shall be calculated from the formula:

\[
\text{Percentage bulking} = \left( \frac{200}{Y} - 1 \right) \times 100
\]

The allowance for bulking for any samples of sand shall be got determined [as per IS: 2386 (Part 3)-1963 Appendix A]. The following table gives the relation between the moisture content and percentage of bulking, which may be used as a rough guidance.

<table>
<thead>
<tr>
<th>Moisture content (Percentage by weight)</th>
<th>Bulking percent (Volume)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>15</td>
</tr>
<tr>
<td>3</td>
<td>20</td>
</tr>
</tbody>
</table>
Moisture content (Percentage by weight) | Bulking percent (Volume)
---|---
4 | 25
5 | 30

8.1.2.2.4 Stacking and Storage of Sand
Sand shall be stacked in regular stacks (refer table given below) on a hard surface or platform so as to prevent the admixture or clay, dust, vegetable and other foreign matter.

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Material</th>
<th>Size of stack (in meters)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Length</td>
</tr>
<tr>
<td>1.</td>
<td>Sand</td>
<td>2.0</td>
</tr>
<tr>
<td></td>
<td>or 5.0</td>
<td>5.0</td>
</tr>
<tr>
<td></td>
<td>or 5.0</td>
<td>1.0</td>
</tr>
</tbody>
</table>

8.1.2.2.5 Mode of Measurement
Sand shall be measured in cubic meters after making due allowance for the bulking due to moisture.

Allowance for bulking due to moisture shall be made as per actual test. However in the absence of actual test results the bulking percentage given under table under section 8.1.2.2.2.4 above may be used at the discretion of the Engineer.

8.1.2.3 Water
Water used shall conform to specifications given below.

8.1.2.3.1 The water used for concrete work, masonry work, making mortars, bricks etc. shall be clean and free from injurious amount of deleterious materials such as oils, acids, alkalis, salts, suspended material, vegetable or organic impurities. As a rule, water that is clear and potable shall be considered satisfactory for all these purposes. Where water can be shown to contain any sugar or an excess of acid, alkali or salt, the Engineer, may refuse the permit of its use.

The water used for curing concrete and brick work as well as for soaking bricks shall also be free from above impurities, as turbid or unclean water is likely to impart its own colour to concrete, bricks or masonry.

In case of large important concrete structures such as dams, water shall be subjected to chemical analysis with respect to its acceptability for use in mixing and curing concrete and its corrosive action on concrete. When water is to be used in compaction for soil for earthen embankment etc. it shall be free from harmful salts and also from solid materials such as roots, grass or wood, the presence of which may be likely to render difficult the formation of a compact homogeneous mass.

8.1.2.3.2 Storage
Wherever water is to be stored for construction purposes, this shall be done in proper storage tanks to prevent any organic impurities getting mixed up with it. The container for transport, storage and handling water shall be clean so as not to cause contamination or deterioration in the quality of the water.

8.1.2.3.3 Permissible Limits

As a guide, the following concentration represents the maximum permissible values of deleterious materials in water:

(i) Not more than 2 ml of 0.1 normal NAOH be required to neutralise 200 ml of the sample.
(ii) Not more than 10 ml of 0.1 normal HCl shall be required to neutralise 20 ml of sample.
(iii) Percentage of salts shall not exceed the following:

<table>
<thead>
<tr>
<th>Type</th>
<th>Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organic</td>
<td>0.20%</td>
</tr>
<tr>
<td>Inorganic</td>
<td>0.03%</td>
</tr>
<tr>
<td>Sulphates</td>
<td>0.05%</td>
</tr>
<tr>
<td>Alkali-Chlorides</td>
<td>0.10%</td>
</tr>
</tbody>
</table>

8.1.3 Grades of Concrete

8.1.3.1 Controlled Concrete

For controlled concrete, design of the mix shall be arrived at after preliminary tests and in its production all necessary precautions shall be taken to ensure that the required works cube strength is attained and maintained. The controlled concrete shall be in eight grades designated as M 100, M 150, M 200, M 250, M 300, M 350, M 400 and M 450 with the suffix 'Controlled' added to it.

The proportions for ingredients chosen shall be such that concrete has adequate workability for conditions prevailing on the work in question, and can be properly compacted with the means available.

Except where it can be shown to the satisfaction of the Engineer that supply, of properly graded aggregate of uniform quality can be maintained till then, completion of work, grading of aggregate should be controlled by obtaining the coarse aggregate in different sizes and blending them in the right proportions as required. Different sizes. However, shall be stocked in separate stock piles. Required quantity of material shall be stock-piled several hours, preferably a day, before use. Grading of coarse and fine aggregate shall be checked as frequently as possible, frequency for a given job being determined by the Engineer to ensure that the suppliers are maintaining the uniform grading as approved for samples in the preliminary tests.

In proportioning concrete, the quantity of both cement and aggregate shall be determined by weight. Where the weight of cement is determined by accepting the maker's weight per bag, a reasonable number of bags shall be weighed separately.
to check the net weight. Where cement is weighed from bulk stocks at site and not by bags, it shall be weighed separately from the aggregates. Water shall either be measured by volume in calibrated tanks or weighed. All measuring equipment shall be maintained in a clean and serviceable condition. Their accuracy shall be periodically checked.

It is most important to keep the specified water cement ratio content and at its correct value. To this end, moisture content in both fine and coarse aggregates shall be determined as frequently as possible, frequency for a given job being determined by the Engineer according to the weather conditions. The amount of mixing water shall then be adjusted to compensate for variations in the moisture content. For the determination of moisture content in the aggregates, IS: 2386 (Part 3) shall be referred to. Suitable adjustments shall also be made in the weights of aggregates to allow for the variation in weight of aggregates due to variation in their moisture content.

Minimum quantity of cement to be used in controlled concrete shall not be less than 210 kgs per cubic metre in plain concrete and not less than 300 kg/per cubic metre in reinforced concrete structural members. The minimum quantity of cement for prestressed concrete work shall not be less than 360 kg/per cubic metre of concrete nor shall it be more than 540 kg/per cubic metre of concrete.

8.1.3.2 Ordinary Concrete

In case of ordinary concrete, mix is not required to be designed by preliminary tests and proportions of cement, fine aggregates and coarse aggregates are specified by volume. The ordinary concrete shall be in four grades designated as M 100, M 150, M 200 and M 250. It can also be specified by volume as given in table below.

In the designation of a concrete mix, letter ‘M’ refers to the mix and the number to the specified 28 days works cube compressive strength of that mix on 150 mm cubes, expressed in kg/cm².

The ordinary concrete mix shall generally be specified by volume. For cement which normally comes in bags and is used by weight, volume shall be worked out taking 50 kg of cement as 0.035 cubic metre in volume. While measuring aggregate by volume, shaking, ramming or hammering shall not be done. Proportioning of sand shall be as per its dry volume and in case it is damp, allowance for ‘bulking’ shall be made as per IS: 2386 (Part 3).

Ingredients required for ordinary concrete containing one 50 kg bag of cement for different proportions of mix shall be as given in table below.
**Table:**

<table>
<thead>
<tr>
<th>Grade of Concrete</th>
<th>Mix by volume</th>
<th>Total quantity of dry aggregates by volume per 50 kg of cement, to be taken as the sum of the individual volumes of fine and coarse aggregates</th>
<th>Proportion of the aggregate of coarse aggregate</th>
<th>Quantity of water per 50 kg of cement (max.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>M100</td>
<td>1:3:6</td>
<td>300 cm³</td>
<td>Generally 1:2 for fine</td>
<td>34 Liters</td>
</tr>
<tr>
<td>M150</td>
<td>1:2:4</td>
<td>220 cm³</td>
<td>Aggregate to coarse</td>
<td>32 Liters</td>
</tr>
<tr>
<td>M200</td>
<td>1:1.5:3</td>
<td>160 cm³</td>
<td>Aggregate by volume</td>
<td>30 Liters</td>
</tr>
<tr>
<td>M250</td>
<td>1:1:2</td>
<td>100 cm³</td>
<td>But subject to a upper limit of 1:1½ and lower limit of 1:3*</td>
<td>27 liters</td>
</tr>
</tbody>
</table>

*Note 1:* The proportions of the aggregates shall be adjusted from upper limit to lower limit progressively as the grading of the fine aggregates becomes finer and the maximum size of coarse aggregate becomes larger.

Example: For an average grading of fine aggregate (that is Zone II of IS: 383-1970) the proportions shall be 1:1½, 1:2 and 1:3, for maximum size of aggregates 10 mm, 20 mm and 40 mm respectively.

*Note 2:* A mix leaner than M 100 (1:3:6) may be used for non-structural parts of the bridges, if specified on the drawing or provided in the Contract. In such case grading of aggregates shall be as specified in the Contract or on the drawings. Other requirements for mixing, placing and curing shall be the same as specified in this Section.

**8.1.4 Strength Requirement of Concrete**

Where ordinary Portland cement conforming to IS: 269 or Portland blast furnace cement conforming to IS: 455 is used, the compressive strength requirements for various grades of concrete controlled as well as ordinary shall be as given in tables below. Where rapid hardening Portland cement is used, the 28 days compressive strength requirements specified in tables below shall be met at 7 days.

For controlled concrete, the mix shall be so designed as to attain in preliminary tests a strength at least 33 percent higher than that required on work tests. Preliminary tests need not be made in case of ordinary concrete.
## Strength Requirements of Concrete (all values in kg/cm²)

<table>
<thead>
<tr>
<th>Grade of concrete</th>
<th>Compressive strength of 15 cm Cubes at 28 days</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Preliminary Test (Min.)</td>
</tr>
<tr>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>M 100</td>
<td>135</td>
</tr>
<tr>
<td>M 150</td>
<td>200</td>
</tr>
<tr>
<td>M 200</td>
<td>260</td>
</tr>
<tr>
<td>M 250</td>
<td>320</td>
</tr>
<tr>
<td>M 300</td>
<td>380</td>
</tr>
<tr>
<td>M 350</td>
<td>440</td>
</tr>
<tr>
<td>M 400</td>
<td>500</td>
</tr>
</tbody>
</table>

**Note 1:** Preliminary Test: A test conducted in a laboratory on the trial mix of concrete produced in the laboratory with the object of:

a) designing a concrete mix before the actual concreting operation starts,
b) determining the adjustments required in the designed mix when there is a change in the materials used during the execution of work, or
c) verifying the strength of concrete mix.

**Note 2:** Works Test: A test conducted either in the field or in a laboratory on the specimens made on the works out of the concrete being used on the works.

**Note 3:** Size of cubes: In the working test, with the approval of the Engineer, 10-cm cubes may be used in place of 15-cm cubes provided the maximum nominal size of aggregate does not exceed 20mm. Even the use of 15 cm cubes should normally be restricted to concretes having a maximum nominal size of aggregate not exceeding 40 mm. Where concrete with aggregates larger than 40 mm size is required to be tested, the size of cubes should be specified by the Engineer, keeping in view that generally the length of side of the cube should be about four times the maximum nominal size of aggregate in the concrete constituting the cube specimen.

**Note 4:** Strength in Relation to size of the Cube: Where 10-cm cubes are used, the values obtained from tests on 10-cm cubes shall be reduced to the extent established by comparative preliminary tests with 10 and 15 cm cubes, or in the absence of such comparative tests, by 10 percentage of the value determined from the tests, in order to give the equipment strength for 15 cm cubes. Where cubes larger than 15-cm are adopted, generally no modification is necessary unless otherwise specified by the Engineer.
Note 5: Cylinder strength: Compressive strength tests may, with the approval of the Engineer, be concluded on 15 cm diameter and 30 cm high cylinders instead of on cubes. Where cylinder strength figures are adopted, the compressive strength figures given above shall be modified according to the formula:

Minimum cylinder comparative strength required = 0.8 compressive strength specified for 15-cm cubes.

### Optional Work Test Requirements of concrete (all values in kg/cm²)

<table>
<thead>
<tr>
<th>Grade of concrete</th>
<th>Compressive strength on 15 cm cubes (min. at 7 days)</th>
<th>Modules of Rupture by Beams Test, Min</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>At 72 + 2 hours</td>
</tr>
<tr>
<td>1</td>
<td></td>
<td>12</td>
</tr>
<tr>
<td>M 100</td>
<td>70</td>
<td>15</td>
</tr>
<tr>
<td>M 150</td>
<td>100</td>
<td>17</td>
</tr>
<tr>
<td>M 200</td>
<td>135</td>
<td>19</td>
</tr>
<tr>
<td>M 250</td>
<td>170</td>
<td>21</td>
</tr>
<tr>
<td>M 300</td>
<td>200</td>
<td>23</td>
</tr>
<tr>
<td>M 350</td>
<td>235</td>
<td>25</td>
</tr>
<tr>
<td>M 400</td>
<td>270</td>
<td>27</td>
</tr>
</tbody>
</table>

Note: Notes 3 to 5 under earlier table are also applicable to this table.

For Permissible Stresses in Concrete, reference may be made to ISI Code 456.

### 8.1.5 Admixtures

No materials other than the essential ingredients i.e. cement, aggregate and water, shall ordinarily be used in the manufacture of concrete or mortar. But the Engineer may permit the use of approved admixtures for imparting special characteristics to the concrete, on satisfactory evidence that its use does not in any way adversely affect the properties of concrete particularly its strength, volume changes, durability and has no deleterious effect on the reinforcement.

### 8.1.6 Size of coarse aggregates

Following shall be the maximum nominal size of coarse aggregate for the different items of work:

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Items of construction</th>
<th>Maximum nominal size of coarse aggregate</th>
</tr>
</thead>
<tbody>
<tr>
<td>i)</td>
<td>RCC well curb RCC well steining and RCC piles.</td>
<td>40 mm</td>
</tr>
<tr>
<td>ii)</td>
<td>PCC well steining.</td>
<td>63 mm</td>
</tr>
</tbody>
</table>
### S. No. | Items of construction | Maximum nominal size of coarse aggregate
--- | --- | ---
iii)  | Well cap or pile cap solid type piers abutments and wing walls, and their pier caps. | 40 mm
iv)  | RCC work in cross girders, deck slab, wearing course, kerb, light posts, ballast wall approach slab, etc. and hollow type piers, abutments, wings walls and their pier caps. | 20 mm
v)  | RCC bearings. | 20 mm
vi)  | For any other item of construction not covered by items (i) to (v) above. | As specified on the drawing or as desired by the Engineer in case it is not specified on drawing.

For heavily, reinforced concrete members as in the case of ribs of main beams, nominal maximum size of aggregate shall usually be restricted to 5 mm less than the minimum lateral clear distance between the main bars or 5 mm less than the minimum cover to the reinforcement, whichever is the smaller.

#### 8.1.7 Proportioning

Proportioning shall be done by volume. Boxes of suitable size shall be used for measuring sand aggregate. The size of the boxes (material) shall be 35 cm x 25 cm and 40 cm deep. The unit of measurement for cement shall be a bag of cement weighing 50 kgs and this shall be as 0.035 cubic metre. While measuring the aggregate and sand, the boxes shall be filled without shaking, ramming or hammering. The proportioning of sand shall be on the basis of its dry volume and in case of damp sand, allowances for bulkage shall be made which shall be determined by the method as given in Clause 8.1.2.2.2 above.

#### 8.1.8 Concrete mixes used for various types of work

Concrete mix shall be as specified in the Contract. If nothing is mentioned in the Contract, it shall be as specified by the Engineer in writing. A rough guide regarding the use of nominal mixes is given below:

<table>
<thead>
<tr>
<th>Nominal Size</th>
<th>Type of work for which used</th>
</tr>
</thead>
<tbody>
<tr>
<td>1:8:16</td>
<td>Foundations of buildings and light structures, and base course of floors.</td>
</tr>
<tr>
<td>1:6:12</td>
<td>Foundations of heavy buildings, plum concrete, hearting of abutments and piers and retaining walls with stone faces in hilly areas.</td>
</tr>
<tr>
<td>1:5:10</td>
<td>Mass concrete and foundations of hydraulic works and heavy buildings</td>
</tr>
<tr>
<td>Nominal Size</td>
<td>Type of work for which used</td>
</tr>
<tr>
<td>--------------</td>
<td>----------------------------</td>
</tr>
<tr>
<td>1:3:6</td>
<td>Mass concrete, bed plates, concrete blocks, canal lining.</td>
</tr>
<tr>
<td>1:2:4</td>
<td>General R.C.C. Buildings and similar works namely beams, slabs, panel walls, stairs, columns retaining walls, pavements, floors, bed plates etc.</td>
</tr>
<tr>
<td>1:1-1/2:3</td>
<td>Important RCC structures, piles, arches, and impermeable construction against water heads.</td>
</tr>
</tbody>
</table>

8.1.9 Form Work

This shall comply with specification as given in Section 7 above.

8.1.10 Consistency

Quantity of water shall be just sufficient to produce dense concrete of required workability for the job. Accurate and strict control shall be kept on the quantity of mixing water. For ordinary concrete mix, the quantity of water required shall generally be equal to 5% by weight of aggregate plus 30% by weight of cement.

From this theoretical quantity of water, deduction shall be made for the surface water present in the aggregate which may be estimated from the table given below:

<table>
<thead>
<tr>
<th>Aggregate</th>
<th>Approximate quantity of surface water Ltrs. Cum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very wet sand</td>
<td>120</td>
</tr>
<tr>
<td>Moderately wet sand</td>
<td>80</td>
</tr>
<tr>
<td>Moist sand</td>
<td>40</td>
</tr>
<tr>
<td>*Moist gravel or crushed rock</td>
<td>20 to 40</td>
</tr>
</tbody>
</table>

*The coarser the aggregate the less water it will carry.

The actual quantity of water required to be added in the field will vary with the quantity of aggregate, consistency required and surface water present in the aggregate. Therefore, the amount of water required shall be determined in the field by carrying out slump/Vee Bee Consistometer Test as described below.
DETERMINATION OF CONSISTENCY OF CONCRETE BY SLUMP TEST

1. Scope

1.1 This method covers test for determining the consistency of concrete samples from concrete being used in construction.

2. Specimen

2.1 The test specimen shall be formed in a mould in the form of the frustum of a cone with internal dimensions as follows:
   a) Bottom diameter 20 cm,
   b) Top diameter 10 cm, and
   c) Height 30 cm.
   The bottom and the top shall be open, parallel to each other and at right angles to the axis of the cone. The mould shall be provided with suitable foot pieces and handles. The internal surface shall be smooth.

2.2 Care shall be taken to ensure that a representative sample is taken.

3. Sampling of Concrete

3.1 Samples of concrete for test specimens shall be taken at the mixer, or in the case of ready-mixed concrete, from the transportation vehicle during discharge. The sample of concrete from which test specimens are made shall be representative of the entire batch. Such samples shall be obtained by repeatedly passing a scope or pail through toe discharging stream of concrete, starting the sampling operation of the beginning of discharge and repeating the operation until the entire batch is discharged. The sample thus obtained shall be transported to the place of moulding of the specimen, and to counteract segregation, the concrete shall be mixed with a shovel until it is uniform in appearance. The location in the work of the batch of concrete thus sampled shall be noted for future reference. In the case of paving concrete, samples may be taken from the batch immediately after depositing on the sub-grade. At least five samples shall be taken from different portion of the pile and these samples shall be thoroughly mixed before being used to form the test specimen.

4. Moulds

4.1 The internal surface of the mould shall be thoroughly clean dry and free from set cement before commencing the test.

5. Procedure

5.1 The mould shall be placed on a smooth flat, non-absorbent surface. The operator should hold the mould firmly in place, while it is being filled, by standing on the foot-pieces. The mould shall be filled to about one-fourth of its height with the concrete which shall then be tamped, using 25 strokes of 16 mm diameter steel rod, 0.6m long and bullet pointed at the lower end. The filling shall be completed in successive layers similar to the first, and the top struck off so that the mould is exactly filled. The mould shall then be removed by rising vertically immediately after filling. The moulded concrete shall then be allowed to subside, and the height of the specimen measured after coming to rest.

5.2 The consistency shall be recorded in terms of millimeters of subsidence of the specimen during the test which is known as the Slump.
### DETERMINATION OF CONSISTENCY OF CONCRETE BY VEE-BEE CONSISTOMETER METHOD

| 1. Scope |  
| --- | --- |
| 1.1 This sub-section deals with the determination of consistency of concrete using a Vee-Bee Consistometer, which determines the time required for transforming by vibration, a concrete specimen in the shape of a conical frustum into a cylinder. |  

| 2. Apparatus |  
| --- | --- |
| 2.1 The Vee-Bee Consistometer consists of: |  
| a) A vibrator table resting upon elastic support. |  
| b) A metal pot. |  
| c) A sheet metal cone, open at both ends; and |  
| d) A standard iron rod. |  
| 2.2 The vibrator table (G) is 380 mm long and 260 mm wide and is supported on rubber shock absorbers at a height of about 305 mm above floor level. The table is mounted on a base (K) which rests on three rubber feet, and is equipped with an electrically operated vibrometer mounted under it operating on either 65 volts or 220 volts, three phase, 50 cycles alternating current. A sheet metal cone (B) open at both ends is placed in the metal pot (A) and the metal pot is fixed on to the vibrator table by means of two wing nuts (H). The sheet metal cone is 30 cm high and its bottom diameter is 20 cm and top diameter 10 cm. A swivel arm holder (M) is fixed to the base and into this is telescoped another swivel arm (N) with funnel (D) and guide sleeve (E). The swivel arm can be readily detached from the vibrating table. The graduated rod (J) is fixed on the swivel arm and at the end of the graduated arm a glass disc (C) is screwed. The graduation of the scale on the rod records the slumps of the concrete cone in centimetres, and the volume of concrete after vibration of the cone in the pot. The standard iron rod is 20 mm in diameter and 500 mm in length. The electrical equipment mounted on the base of the Consistometer consists of a fixed plug and connector for the electric supply cable, plug and socket connection for the detachable cable connected to the vibrometer and a control switch. |  

| 3. Procedure |  
| --- | --- |
| 3.1 A Slump test as described above is performed in the sheet metal cylindrical pot of Consistometer. The glass disc attached to the swivel arm is moved and is placed just on top of the slump cone in the pot and before the cone is lifted up the position of the concrete cone is noted by adjusting the glass disc attached to the swivel arm. The cone is then lifted up and the slump is noted on the graduated rod by lowering the glass disc on top of the concrete cone. The electrical vibrator is then switched on and the concrete is allowed to spread out in the pot. The vibration is continued until the whole concrete surface uniformly adheres to the glass disc as indicated in figure and the time taken for this to be attained is noted with a stopwatch. The time is recorded in seconds. |  

| 4. Result |  
| --- | --- |
| 4.1 The consistency of the concrete is expressed in Vee-Bee degrees which are equal to the time in seconds under 3.1 above. |  
| 4.2 The required slump is obtained on the basis of the consistency scale given in table below. |  
| 4.2.1 The curve in Fig. 3 indicates the relationship between slump in cm and the degrees covered by the consistency scale given in table below: |
### Section 6 - Works Requirements

#### Bidding Document for IDIPT (UK)

**Contract Package No:** UK/IDIPT-III/ DDN/ 02

<table>
<thead>
<tr>
<th>Consistency</th>
<th>No. of Vee-Bee Degrees</th>
<th>Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moist Earth</td>
<td>40 to 25 to 20</td>
<td>Particles of coarse aggregate in the concrete are adhesive but concrete does not clot. Risk of segregation.</td>
</tr>
<tr>
<td>Very Dry</td>
<td>20 to 15 to 10</td>
<td>Concrete has the consistency of very stiff porridge, forms a stiff mound when dumped, and barely tends to shake or roll itself to form an almost horizontal surface when conveyed for a long time, in say a wheel barrow.</td>
</tr>
<tr>
<td>Dry</td>
<td>10 to 7 to 5</td>
<td>Concrete has the consistency of stiff porridge forms a mound when dumped and shakes or rolls itself to form a horizontal surface when conveyed for a long time in, say, a wheel barrow.</td>
</tr>
<tr>
<td>Plastic</td>
<td>5 to 4 to 3</td>
<td>Concrete can be shaped into a ball between the palms of the hands and adheres to the skin.</td>
</tr>
<tr>
<td>Semi-fluid</td>
<td>3 to 2 to 1</td>
<td>Concrete cannot be rolled into a ball between the palms of the hands, but spreads out even though slowly, and without affecting the cohesion of the constituents so that segregation does not occur.</td>
</tr>
<tr>
<td>Fluid</td>
<td>More fluid than 1</td>
<td>Concrete spreads out rapidly and segregation takes place.</td>
</tr>
</tbody>
</table>

The following slumps are adopted for different works.

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Type of work</th>
<th>Slumps</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Mass concrete in foundations, footings, retaining walls and pavements.</td>
<td>When vibrators are used: 10 mm to 25 mm, When vibrators are not used: 30 mm to 75 mm</td>
</tr>
<tr>
<td>2</td>
<td>Thin flooring of less than 74 mm thickness.</td>
<td>When vibrators are used: 25 mm to 40 mm, When vibrators are not used: 75 mm to 10 mm</td>
</tr>
<tr>
<td>3</td>
<td>Reinforced cement concrete work</td>
<td>See under Sub-section 8.2 RCC.</td>
</tr>
</tbody>
</table>

**8.1.11 Mixing of Concrete**

Mixing of cement concrete shall, as a rule, be done in a mechanical mixer. However, the Engineer may permit hand mixing in specific cases where in his opinion it is not practicable to resort to mechanical mixing, either on account of the quantity of cement concrete required is small or for any other reason. In such cases he should ensure that the inferior quality of concrete produced by hand mixing will not adversely affect the structure.

**8.1.11.1 Mechanical Mixing**

Measured quantity of aggregate, sand and cement required for each batch shall be poured into the drum of the mechanical mixer while it is continuously running after about half a minute of dry mixing, measured quantity of water required for each
batch of concrete mix shall be added gradually and mixing continued for another one and a half minute. It shall be ensured that total mixing time for each batch shall be at least two minutes. The mixed concrete from one drum shall then be discharged completely and the drum re-charged as before for the next batch mix. The mixed concrete shall be used within 30 minutes from the time of adding water. The mixer shall be cleaned thoroughly before suspending the work each time, revolving the drum with plenty of water.

8.1.11.2 Hand Mixing

A heap of convenient size shall be formed by packing the calculated quantity of aggregate sand and cement (in that order) in layers. The ingredients shall be mixed, dry thoroughly by turning them over and over again. The calculated quantity of water then shall be added gradually and the whole thing slowly and thoroughly mixed again.

8.1.12 Transport, placing and compaction

The method of transporting and placing concrete shall be approved by the Engineer. Concrete shall be so transported and placed that no contamination, segregation or loss of its constituent materials takes place.

All form work shall be cleaned and made free from standing water, snow or ice immediately before placing of concrete.

No concrete shall be placed in any part of the structure, until the approval of the Engineer has been obtained.

If concreting is not started within 24 hours of the approval being given, it shall have to be obtained again from the Engineer. Concreting then shall proceed continuously over the area between constructions joints. Fresh concrete shall not be placed against concrete which has been in position for more than 30 minutes unless a proper construction joints formed.

Concrete when deposited shall have a temperature of not less than 4.5°C and not more than 38°C. It shall be compacted in its final position within 30 minutes of its discharge from the mixer unless carried in properly designed agitators, operating continuously, when this time shall be within 2 hours of the addition of cement to the mix and within 30 minutes of its discharge from the agitator.

Except where otherwise agreed to by the Engineer, concrete shall be deposited in horizontal layers to a compacted depth of not more than 0.45 metre when internal vibrators are used and not exceeding 0.30 metre in all other cases.
Unless otherwise agreed by the Engineer concrete shall not be dropped into place from a height exceeding 2 metres. When trucking or chutes are used they shall be kept clean and used in such a way as to avoid segregation.

When concrete is conveyed by chute, the plant shall be of such size and design as to ensure practically continuous flow. Slope of the chute shall be so adjusted that the concrete flows without the use of an excessive quantity of water and without any segregation of its ingredients. The delivery end of the chute shall be as close as possible to the point of deposit. The chute shall be thoroughly flushed with water before and after each working period and the water used for this purpose shall be discharged outside the form work.

When concreting has to be resumed on a surface which has hardened, it shall be roughened, swept clean, thoroughly wetted, and covered a 13 mm thick layer of mortar composed of cement and sand in the same ratio as in the concrete mix itself. This 13 mm layer or mortar shall be freshly mixed and placed immediately before placing of new concrete.

Where concrete has not fully hardened, all laitance shall be removed by scrubbing the wet surface with wire of bristle brushes, care being taken to avoid dislodgement of any particles of coarse aggregate. The surface shall then be thoroughly wetted, all free water removed, and then coated with net cement grout. The first layer of concrete to be placed on this surface shall not exceed 150mm in thickness, and shall be well rammed against old work, particular attention being given to corners and close spots.

All concrete shall be compacted to produce a dense homogenous mass with the assistance of vibrators. Unless otherwise permitted by the Engineer for exceptional cases, such as concreting under water, where vibrator in serviceable condition shall be kept at site so that spare equipment is always available in the event of breakdowns.

Internal vibrators shall be capable of producing not less than 10,000 cycles per minute, and external of form vibrators not less than 3,000 cycles per minute.

| 8.1.13 | Mechanical Vibration |
| 8.1.13.1 | General |

Use of mechanical vibrators for compacting concrete is recommended, provided that the reduced water content recommended under paragraph 8.1.10 above is adopted. The number and type vibrations shall be subject to the approval of the Executive Engineer. If nothing is specified, only, vibrations of the internal type of shall be used.
Mechanical vibrator shall be adequately powdered and capable of transmitting vibrations of the required frequency to the concrete. A sufficient number of mechanical vibrators shall be provided on the batch so that each batch may be thoroughly compacted immediately after placing and that there will be no delay in placing and compacting of ensuing batches. The intensity and duration of vibration shall be sufficient to ensure complete settlement and compaction without any stratification of the successive layers or separation of ingredients. Preliminary experiment in vibrating shall be conducted under actual conditions of mixed and placement in order to determine the optimum duration and method of vibration.

Vibrations should be continued till the concrete is thoroughly compacted and the voids filled as indicated by the appearance of mortar or paste at the exposed surface or at faces of contact with the forms.

8.1.13.2 Type of Vibrators

Vibrators are of the following four general types:

a) Internal vibrators: Which consist of metal spud or rod which is inserted into newly placed concrete and which vibrates while it is being withdrawn.

b) External or 'form' vibrators: Which are attached to form work and external shuttering of walls, column etc. Forms transmit the vibrating action to the concrete.

c) Surface vibrators: Which are mounted on screeds or platforms and which are chiefly used for consolidating road slab, floors etc.

d) Vibration tables: Which are used for making precast products.

8.1.13.2.1 Internal Type Vibrators

Internal vibrators shall be allowed to penetrate as deeply as possible under their own weight and shall so consolidate the successive layers as to breakup effectively all strata or seam. The vibrators shall be inserted and withdrawn slowly in such a manner as not to leave voids in the plastic concrete. The entire operation shall be conducted in a systematic matter and each course or layer vibrated uniformly. The method of dumping or depositing the loads shall be so arranged as to keep the vibrators working continuously during placing operations. The course shall be kept approximately level, and the concrete, even when deposited in thin layers, shall be as stiff as can be satisfactorily worked. Care shall be taken not to disturb a set of partially set layer. The vibrations shall be held vertical as far as possible.

Under no condition shall internal vibrations strike the face of the forms, nor shall reinforcement steel or embedded metal be jarred with sufficient force to impair the bond between the concrete and the metal.

8.1.13.2.2 External or Form Vibrators
These are particularly effective on columns and in the citing of pre-cast units such as pipes, slabs, piles, etc. The machine should be fastened to a wale or gut and transmission of the vibration around perimeter of the member should be further assisted by means of encircling chain where this is practicable. Forms vibrators shall also be used on thin wall sections where reinforcement, ties and spreaders interfere too much with internal vibrators.

8.1.13.2.3 Surface Vibrators

While using surface vibrators, care shall be taken to ensure that the surface vibrator compacts the layer being placed to its full depth. If this requirement is not met, either the depth of the layer shall be reduced or a more powerful machine shall be used.

8.1.13.2.4 Vibrating Tables

Vibrating tables are used for precast units which are made in moulds fastened to the table. Tables are available in various sizes and are usual equipped with adjustable eccentrics so that both the speed and amplitude can be adjusted.

8.1.14 Concreting under water

When it is necessary to deposit concrete under water, the methods equipment, material and properties of the mix to be used shall be got approved from the Engineer before any work is started. Such concrete shall not be considered as ‘Concrete.’

Concrete shall not be placed in water having a temperature below 4.5\(^{\circ}\) C. The temperature of the concrete, when deposited, shall be not less than 16\(^{\circ}\) C, nor more than 38\(^{\circ}\) C. The material shall be so proportioned as to produce a concrete having a slump of not less than 10 mm and not more than 180 mm. The slump shall be tested as per IS: 516.

Cofferdams or forms shall be sufficiently tight, to ensure still water conditions if practicable, and in any case to reduce the flow of water to less than 3 metres per minute through the space into which concrete is to be deposited. Cofferdams or forms in still water shall be sufficiently tight to prevent loss of mortar through the joints in the walls. Pumping shall not be done while concrete is being placed, or until 24 hours thereafter.

Concrete shall be deposited continuously until it has been brought to the required height. While depositing the top surface shall always be kept as level as possible and formation of seams avoided. For depositing concrete anyone of the following methods may be used:
(a) Tremic - When concrete is to be deposited under water by means of a tremic, the top section of the tremic shall be a hopper large enough to hold full batch for the mix of the entire contents of the transporting bucket if any. The tremic pipe shall not be less than 200 mm in diameter, and shall be large enough to allow a free flow of concrete and strong enough to withstand the external pressure of the water in which it is suspended, even if a partial vacuum develops inside the pipe. Preferably, flanged steel pipe of adequate strength for the job shall be used. A separate lifting device shall be provided for each tremic pipe with its hopper at the upper end. Unless the lower end of the pipe is equipped with an approved automatic check valve, the upper end of the pipe shall be plugged with a wadding of gunny sacking or other approved material before delivering the concrete to the tremic pipe through the hopper so that when the concrete is forced down from the hopper to the pipe it will force the plug (and along with it any water in the pipe) down the pipe and out of the bottom end, thus establishing a continuous stream of concrete. It will be necessary to raise slowly the tremic in order to allow a uniform flow of concrete, but it shall not be emptied so that water enters above the concrete in the pipe. At all the times after the placing of concrete is started and until all the required quantity has been placed, the lower end of the tremic pipe shall be kept below the top surface of the plastic concrete. This will cause the concrete to build up from below instead of flowing out over the surface, and thus avoid formation of layers of laitance. If the charge in the tremic is lost while depositing the tremic shall be raised above the concrete surface, and unless sealed by a check valve it shall be re-plugged at the top end, as at the beginning, before refilling for depositing further concrete.

(b) Drop/Bottom Bucket: The top of the bucket shall be closed. The bottom doors shall move freely downward and outward when tripped. The bucket shall be filled completely and lowered slowly to avoid backwash. It shall not be dumped until it rests on the surface upon which the concrete is to be deposited and when discharged shall be withdrawn slowly until well above the concrete.

To minimize the formation of laitance, great care shall be exercised not to disturb the concrete as far as possible while it is being deposited.

8.1.15 Working in extreme weather

Where concrete is to be deposited at or near freezing temperatures, precautions shall be taken to ensure that at the time of placing it has a temperature of not less than 4.5\(^{\circ}\) C and that this temperature after it has been placed and compacted is maintained until it has thoroughly hardened. When necessary the ingredients shall
be heated before mixing and concrete carefully protected after placing; in general, heating mixing water alone to about 60° C may be sufficient for this purpose. Dependence shall not be placed on salt or other chemicals for the prevention of freezing. Calcium chloride upto 1½% by weight of the cement can be used to accelerate the rate of hardening. Use of calcium chloride in excess of this percentage is considered harmful. No frozen material or materials containing ice shall be used. All concrete damaged by frost shall be removed. It is recommended that concrete exposed to freezing whether shall have entrained air and the water content of the mix shall not exceed 30 liters per 50 kg of cement.

When depositing concrete in very hot weather, precautions shall be taken to that the temperature of wet concrete does not exceed 38° C while placing. This shall be achieved by stacking aggregate under the shade and keeping them moist, using cold water, reducing the time between mixing and placing to the minimum, cooling formwork by sprinkling water, starting curing before concrete dries out and restricting concreting, as far as possible, to mornings and evenings.

8.1.16 Construction joints

Concreting shall be carried out continually upto the construction joints, the position and details of which shall be as shown on approved drawings or as directed by the Engineer. Such joints shall, however, be kept to the minimum.

For a critical construction joint, a stopping board shall be fixed previously at the pre-determined position and shall be properly stayed for sufficient lateral rigidity to prevent its displacement or plugging when concrete is compacted against it. Concreting shall be continued right upto the board. The board shall not be removed before the expiry of the specified period for removal of vertical forms.

Before resuming work at any construction joint when concrete has not yet fully hardened, all laitance shall be removed thoroughly, care being taken to avoid dislodgement of coarse aggregates.

When work has to be resumed on a surface which has hardened it shall be thoroughly hacked, swept clean, wetted and covered with a layer of neat cement grout. The neat cement grout shall be followed by a 13 mm thick layer of mortar mixed in the same proportion as in concrete and concreting resumed immediately thereafter. The first batch of concrete shall be rammed against the old work to avoid formation of any stone pockets, particular attention being paid to corners and close spots.

8.1.17 Use of Plums in Ordinary Concrete
Stone plums shall not be used unless specified on the drawings. When used the size of stone plums may be from 150 to 300 mm. The maximum dimension of these stones or plums shall not exceed 1/3rd the least dimension of the members.

All plums shall be hard, durable, clean and free from soft materials or loose pieces or deleterious substance in them and shall not have sharp corners.

During concreting the first layer of concrete of the specified mix shall be laid to a thickness of the maximum size of plums to be used. The plums shall then be laid while the top portion of this concrete is still green but sufficiently stiff to prevent complete submergence of the plums under their own weight. These plums shall be about half embedded in the concrete and the remaining part exposed so as to form a key with the next layer of concrete. No plums shall be used for concrete laid under water.

While placing the plums, care shall be taken to see that the clear distance between any to plums is not less than either the width or thickness of either of the plums. The distance from plums to the outer surface or from any steel reinforcement shall be equal to greatest width of the plum.

If plums of stratified stone are used, they shall be laid on their natural bed. Stones with concave faces shall be laid with the concave upwards.

The thickness of the next and successive layers of concrete shall be at least twice that of the largest plums.

The total volume of plums shall not exceed 15 percent of the volume of the finished concrete.

8.1.18 Finishing

Immediately after the removal of forms, all exposed bars or bolts passing through the Reinforced Cement Concrete member and used for shuttering or any other purpose shall be cut inside the Reinforced Cement Concrete member to a depth of at least 25 mm below the surface of the concrete and the resulting holes be closed by cement mortar. All fins caused by form joints, all cavities produced by the removal of form ties and all other holes and depressions, honeycomb spots, broken edges or corners, and other defects, shall be thoroughly cleaned, saturated with water, and carefully pointed and rendered true with mortar of cement and fine aggregate mixed in the proportions used in the grade of concrete that is being finished and of as dry a consistency as is possible to use. Considerable pressure shall be applied in filling and pointing to ensure thorough filling in all voids. Surfaces which have been pointed shall be kept moist for a period of twenty four hours.
All construction and expansion joints in the completed work shall be left carefully tooled and free from any mortar and concrete. Expansion joint filler shall be left exposed for its full length clean and true edges.

If rock pockets/honey-combs, in the opinion of the Engineer are of such an extent or character as to affect the strength of the structure materially or to endanger the life of the steel reinforcement, he may declare the concrete defective and require the removal and replacement of the portions of the structure affected.

8.1.19 Curing of Concrete

8.1.19.1 Protection and water curing

Immediately after compaction, concrete shall be protected against harmful effects of weather, including rain, running water, shocks, vibration, traffic, rapid temperature changes, frost and drying out process. It shall be covered with wet sacking, hessian or other similar absorbent material approved by the Engineer soon after the initial set, and shall be kept continuously wet for a period of not less than 14 days from the date of placement. Masonry work over the foundation concrete may be started after 48 hours of it's laying but the curing of concrete shall be continued for a minimum period of 14 days.

8.1.19.2 Steam curing

Where steam curing is adopted it shall be ensured that it is done in a suitable enclosure to contain the live steam in order to minimize moisture and heat losses. The initial application of the stream shall be from two to four hours after the final placement of concrete to allow the initial set of the concrete to take place.

Where retarders are used, the waiting period before application of the steam shall be increased from four to six hours.

The steam shall be at 100 percentage relative humidity to prevent loss of moisture and to provide excess moisture for proper hydration of the cement. The application of steam shall not be directly on the concrete, and the ambient air temperature shall increase at a rate not exceeding $5^\circ\text{C}$ per hour until a maximum temperature of $60^\circ\text{C}$ to $70^\circ\text{C}$ is reached. The maximum temperature shall be maintained until the concrete has reached the desired strength.

When steam curing is discontinued the ambient air temperature shall not drop at a rate exceeding $5^\circ\text{C}$ per hour until a temperature of about $10^\circ\text{C}$ above the temperature of the air to which, the concrete, will be exposed, has been reached.

The concrete shall not be exposed to temperature below freezing for at least six days after casting.
Care shall be exercised to protect the concrete from all shakings, jarring and other disturbance during the period of curing.

8.1.20 Tests and Standard of Acceptance

8.1.20.1 Preliminary tests for Controlled Concrete

For controlled concrete preliminary test shall consist of three sets of separate tests, and in each set, tests shall be conducted on six specimens. Not more than one set of six specimens shall be made on any particular day. On the six specimens in each set, three shall be tested at seven days and the remaining three at 28 days. The preliminary tests at 7 days are intended only to indicate the strength likely to be attained at 28 days.

8.1.20.2 Works Strength Tests for Controlled and Ordinary Concrete

Works strength tests shall be made in accordance with IS: 516. Each test shall be conducted on ten specimens, five of which shall be tested at seven days and the remaining five at 28 days. The samples concrete shall be taken on each day of concreting and cubes shall be made at the rate of one for every 5 cubic metre of concrete or a part thereof. However, if concreting done in a day is less than 15 cubic metres, the minimum number of cubes can be reduced to 6 with the specific permission of the Engineer.

Similar works tests shall be carried out whenever the quality and grading of materials is changed irrespective of the quantity of concrete poured. The number of specimens may be suitably increased as deemed necessary by the Engineer, when procedure of tests given above reveals a poor quality of concrete and in other special cases.

All work shall be carried out under the supervision of a qualified and a competent Engineer who will supervise proportioning, placing and compacting of concrete at all stages.

All necessary labour, materials, equipment, etc., for sampling, preparing test cubes, curing etc. shall be provided by the Contractor. Testing of the materials and concrete may be arranged by the Engineer in an approved laboratory are the cost of the Contractor.

8.1.20.3 Standard of Acceptance

The average strength of the group of cubes cast for each day shall not be less than the specified works cube strength. 20 percent of the cubes cast for each batch may have values less than the specified strength, provided the lowest value is not less than 85 percent of the specified strength.
A register for work test of concrete must be maintained as record which is given as given in table below.

**REGISTER OF WORK TEST OF CONCRETE**

<table>
<thead>
<tr>
<th>Name of Work</th>
<th>Concrete Mix</th>
<th>Compressive Strength</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name of Contractor.</td>
<td>M 100</td>
<td>As given in the two tables under section 8.1.4 above.</td>
</tr>
<tr>
<td>Agreement No.</td>
<td>M 150</td>
<td></td>
</tr>
<tr>
<td>Sample No.</td>
<td>M 200</td>
<td></td>
</tr>
<tr>
<td>Identification mark.</td>
<td>M 250</td>
<td></td>
</tr>
<tr>
<td>Portion of work and quantity represented sample.</td>
<td>M 300</td>
<td></td>
</tr>
<tr>
<td>Date and time of casting cubes.</td>
<td>M 350</td>
<td></td>
</tr>
<tr>
<td>Proportion of mix.</td>
<td>M 400</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>7 days test</th>
<th>Cube No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Due date of test.</td>
<td></td>
</tr>
<tr>
<td>2. Actual date of test.</td>
<td></td>
</tr>
<tr>
<td>3. Actual compressive strength.</td>
<td></td>
</tr>
<tr>
<td>(a) Minimum</td>
<td></td>
</tr>
<tr>
<td>(b) Maximum</td>
<td></td>
</tr>
<tr>
<td>(c) Average</td>
<td></td>
</tr>
<tr>
<td>4. Is average compressive strength,</td>
<td>Yes/No</td>
</tr>
<tr>
<td>equal to or more than specified compressive</td>
<td>Yes/No</td>
</tr>
<tr>
<td>strength?</td>
<td>Yes/No</td>
</tr>
<tr>
<td>5. Is minimum compressive strength equal to or</td>
<td>Yes/No</td>
</tr>
<tr>
<td>more than specified compressive strength?</td>
<td>Yes/No</td>
</tr>
<tr>
<td>6. 15% of average strength.</td>
<td></td>
</tr>
<tr>
<td>7. Difference between 3 (a) &amp; 3 (b).</td>
<td></td>
</tr>
<tr>
<td>8. Is 7 less than 6?</td>
<td>Yes/No</td>
</tr>
<tr>
<td>9. If answer to (4 &amp; 8) are yes, or answer to</td>
<td>Acceptable</td>
</tr>
<tr>
<td>5 is yes.</td>
<td>Acceptable</td>
</tr>
<tr>
<td>10. If answers to 4 and/ or 8 are/is No, or</td>
<td>Not acceptable</td>
</tr>
<tr>
<td>answer to 5 and 8 are No.</td>
<td>Not acceptable</td>
</tr>
<tr>
<td>11. If answer to 9 is acceptable.</td>
<td>28 days test not required.</td>
</tr>
<tr>
<td>12. If answer to 10 is not acceptable.</td>
<td>28 days test required.</td>
</tr>
</tbody>
</table>
Section 6 - Works Requirements

7 days test

<table>
<thead>
<tr>
<th>Cube No.</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td></td>
</tr>
</tbody>
</table>

JE | AE/AEE

Note: Units for S. No. 3a, b, c, 6, 7 & 8 are kg per square cm.

28 days test

<table>
<thead>
<tr>
<th>Cube No.</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>5</td>
<td>6</td>
<td></td>
</tr>
</tbody>
</table>

1. Due date of test
2. Actual date of test
3. Delay in testing
4. Increase in strength @ 1.50 kg/cm², per day of delay.
5. Anticipated compressive strength (Min. specified + 4)
6. Actual compressive strength.
   (a) Minimum
   (b) Maximum
   (c) Average
7. Is average compressive strength, equal to or more than specified / anticipated compressive strength? Yes/ No Yes/ No Yes/ No
8. If answer to 7 is yes. Accept at full rates.
9. If answer to 7 is No. See last table in this Sub-section under item 5.4 b & c.

JE | AE/AEE | EE

Note: Units for S. No. 5, 6 a, b, c are kg per square cm.

For preliminary test, work test and additional test, reference may be made to the three tables as given below respectively.

**PRELIMINARY TEST FOR COMPRESSION STRENGTH OF CONCRETE**

1. Scope
   1.1 This method covers compression test on concrete made in a laboratory where accurate control of quantities of materials and test conditions is possible.

2. Test Specimen
   2.1 Test specimens shall be either cubes or cylinders whose size shall be as given in table below:

**SIZES OF TEST SPECIMENS**
### Maximum size of coarse aggregates

<table>
<thead>
<tr>
<th>SIZE OF SPECIMENS</th>
<th>Cubes (cm.)</th>
<th>Cylinder (Diameter cm.)</th>
<th>Height (cm.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not exceeding 20mm.</td>
<td>10x10x10</td>
<td>15</td>
<td>30</td>
</tr>
<tr>
<td>Greater than 20mm. but not exceeding 38mm.</td>
<td>15x15x15</td>
<td>15</td>
<td>30</td>
</tr>
<tr>
<td>Greater than 38mm after wet screening or hand picking aggregates greater than 38mm.</td>
<td>15x15x15</td>
<td>15</td>
<td>30</td>
</tr>
</tbody>
</table>

The size of the cubic specimen shall be generally (15cmx15cmx15cm) and this size shall be preferred to (10cmx10cmx10cm). Where prior consent of the Engineer has been obtained, the size of the specimen may be (10cmx10cmx10cm).

### Materials

3.1 The materials and proportions used in making the test specimens including the water content shall be similar in all respects to those to be used in the works. The cement on arrival at the laboratory shall be mixed dry either by hand or in a suitable mixer so as to ensure uniformity, care being taken to avoid the intrusion of foreign matter, and then stored in airtight containers.

3.2 All material shall be brought to a temperature of 81º F ± 40º F (27º C ± 2º C) before beginning the tests. The aggregate shall be dry.

3.3 The quantities of cement, aggregate and water for each batch shall be determined by weight to an accuracy of 1 in 1000.

### Preparation of Test Specimen

4.1 The concrete shall be mixed by hand, or in a small batch mixer in such a manner as to avoid loss of water. If the concrete is mixed by hand, the cement and fine aggregate shall be first mixed dry until the mixture is uniform in colour. The coarse aggregate shall then be added and mixed with the cement and fine aggregate. Water shall be then be added and the whole mixed thoroughly until the resulting concrete is uniform in colour, and in no case for less than two minutes. If a batch mixer is used, all materials may be placed together in the mixer and mixed thoroughly until the resulting concrete is uniform in colour, and in no case for less than two minutes.

4.2 The interior surface of the mould and base plate shall be lightly oiled before the concrete is placed in the mould. Test specimens shall be moulded by placing the fresh concrete in the mould in three layers, each approximately one third the volume of the mould. In placing each scoopful of concrete, the scoop shall be moved round the top edge of the mould as the concrete slides from it in order to ensure symmetrical distribution of concrete within the mould. Each layer shall be rodded 25
times with 16 mm rod, 0.6 meter in length, bullet point at the lower end. The strokes shall be distributed in a uniform manner over the cross section of the mould and shall penetrate into the under laying layer. The bottom layer shall be rodded throughout its depth. After the top layer has been rodded, the surface of the concrete shall be struck off with a trowel and covered with a glass plate at least 6 mm thick, or with a machined metal plate, which may be later used in capping the test specimen. The whole process of moulding shall be carried out in such a manner as to preclude the alternation of the water cement ratio of the concrete by the loss of water either by leakage from the bottom or overflowing from the top of the mould.

4.2.1 Where it is proposed to use mechanical vibrators for compacting the concrete at the site of work and to allow increased stresses the test specimens may be compacted with a mechanical vibrator.

4.3 Capping of Cylindrical Test Specimen

4.3.1 Two to four hours after moulding the cylindrical test specimen, if made in metal moulds, may be capped with a thin cap of neat cement paste. The cap shall be formed by means of a piece of plate glass 6 mm thick, or a machined metal plate 13 mm thick and of a size 50 to 75 mm larger than that of mould. The plate shall be worked on the cement paste until the plate rests on top of the mould. The cement for capping shall be mixed to a stiff paste from about 2 to 4 hours before it is to be used in order to avoid the tendency of the cap to shrink. Adhesion of the concrete to the top and bottom plates may be avoided by coating them with heavy oil or grease.

4.3.2 If cylindrical specimens are not capped with neat cement paste, they shall be capped before testing in such a manner that the ends are perfectly plane and at right angles to the axis of the cylinder. The material used for capping and the thickness of the cap shall be such that the capping will now flow or fracture under the load.

4.3.3 It is desirable that the capping material should have a value for modulus of elasticity equal to or greater than that of the concrete under test.

5. Curing and storage of test specimen

5.1 Immediately the moulding is completed the moulds, containing the test specimens shall be placed in moist air of at least 90 percent relative humidity and at a temperature of 81°F ± 4°F (27°C ± 2°C) for 24½ hour. After 24 hours, the test specimens shall be removed from the moulds, marked and placed in saturated lime solution at a temperature of 81°F ± 4°F (27°C ± 2°C) until required for rest.

6. Method of testing

6.1 The tests shall be made at the age of concrete corresponding to that for which the strengths are specified.

6.2 Compression tests shall be made immediately upon removal of the concrete test specimen from the curing room i.e., the test specimens shall be loaded in damp condition. The dimensions of the test specimens shall be measured in millimeters accurate to 0.5 mm.

6.3 The metal bearing plates of the testing machine shall be placed in contact with the each of the testing specimens. Cushioning materials shall not be used. In the case of cubes, the test specimens shall be
placed in the machine in such a manner that the load is applied to the sides of the specimens as cast. An adjustable bearing block shall be used to transmit the load to the test specimen. The size of the bearing block shall be the same or slightly larger than that of the test specimen. The upper or lower section of the bearing block shall be kept in motion as the head of the testing machine is brought to a bearing on the test specimen.

6.3.1 The load shall be applied axially without shock at the rate of approximately 140 kg/sq.cm. per minute. The total indicated by the testing machine at failure of the test specimen shall be recorded and the unit compressive strength calculated in kg/sq. cm. using the area computed from the measured dimensions of the test specimen. The type of failure and appearance of the concrete shall be noted.

7. Standard of Acceptance

This shall be as per Clause 8.1.20.3 above.

WORKS TEST FOR COMPRESSION OF CONCRETE

1. Scope

1.1 This method is intended to apply to the moulding, storing and testing of compression test specimen of concrete samples from concrete being used in construction.

2. Specimen

2.1 Test specimens shall either be cubes or cylinders whose sizes shall be as given in following table below:

<table>
<thead>
<tr>
<th>SIZES OF TEST SPECIMENS</th>
<th>SIZE OF SPECIMENS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Maximum size of coarse aggregates</strong></td>
<td><strong>Cubes</strong></td>
</tr>
<tr>
<td>cm.</td>
<td>Dia. cm.</td>
</tr>
<tr>
<td>Not exceeding 20 mm.</td>
<td>10x10x10</td>
</tr>
<tr>
<td>Greater than 20 mm but not exceeding 40 mm.</td>
<td>15x15x15</td>
</tr>
</tbody>
</table>

2.2 The moulds for test specimen shall be made of non-absorbent material and shall be substantial enough to hold their form during the moulding of the test specimens. They shall not vary from standard dimensions given under 2.1 above by more than one percent. The moulds shall be so constructed that there will be no leakage of water from the test specimen during mouldings.

Note: Satisfactory moulds can be made from machined iron or steel castings, machined steel wire pipe, cold drawn steel tubing, rolled metal plate or galvanized iron.

2.2.1 Each mould shall be provided with a base plate having a plane surface and made of non-absorbent material. This plate shall be large enough in diameter to support the moulds property without leakage. Glass plate shall not be less than 6.5 mm thick or planed metal not less than 12 mm thick shall be used for this purpose. A similar plate shall be provided for...
### Section 6 - Works Requirements

#### 6.99

**Bidding Document for IDIPT (UK)**

**Contract Package No:** UK/IDIPT-III/ DDN/ 02

<table>
<thead>
<tr>
<th>3.</th>
<th>Sampling of concrete</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.1</td>
<td>Samples for concrete for test specimen shall be taken at the mixer or in the case of ready mixed concrete from the transportation vehicle during discharge. The sample of concrete from which test specimens are made shall be representative of the entire batch. Such samples shall be obtained by repeatedly passing a scoop or pail through the discharging stream of concrete, stacking the sampling operation until the entire batch is discharged. The sample thus obtained shall be transported to the place of moulding of specimen and to counteract segregation the concrete shall be mixed with a shovel until it is uniform in appearance. The location in the work of the batch of concrete, thus samples shall be noted for further reference. In the case of paving concrete, samples may be taken from the batch immediately after deposition on the subgrade. At least five samples shall be taken from different positions of the pile and these samples shall be thoroughly mixed before being used to form the test specimen.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>4.</th>
<th>Preparation of test specimens</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.1</td>
<td>The interior surface of the mould and base plate shall be lightly oiled before the concrete is placed in the mould. From the samples of concrete obtained as described under 3.1 above, the test specimen shall be immediately moulded by one of the following method:</td>
</tr>
</tbody>
</table>

**(a)** When the job concrete is compacted by ordinary methods, the 1st specimen shall be moulded by placing the test concrete in the mould in these layers each approximately one-third of the volume of the mould in placing each scoopful of concrete, the scoop shall be moved around the top edge of the mould as the concrete there slides from it, in order to ensure a uniform distribution of concrete within the mould. Each layer shall be rodded 25 times with a 16 mm rod 60 cm in length, bullet point at lower end. The strokes shall be distributed in a uniform manner over the cross section of the mould and shall penetrate into the under lying layer. The bottom layer shall be rodded throughout its depth. After the top layer has been rodded, the surface of the concrete shall be struck off with a trowel and covered with a glass plate at least 6.5 mm thick or a machined metal plate which may later be used in capping the cylindrical test specimens. The whole process of moulding shall be carried out in such a manner as to preclude the alternation of the water-cement ratio of the concrete by loss of water either by leakage from the bottom or over flow from the mould. |

**(b)** When the job concrete is placed by vibration and the consistency of the concrete is such that the 1st specimen cannot be properly moulded by hand rodding as directed under (a) above, the specimens shall be vibrated to give a compaction corresponding to that of the job concrete. The fresh concrete shall be placed in the mould in two layers, each approximately half the volume of the mould. In placing each scoopful of concrete, the scoop shall be moved around the top edge of the mould as the concrete there slides from it, in order to ensure a symmetrical distribution of concrete within the mould. Either internal or external vibrators may be used. The vibration of each layer not be continued longer than is necessary to secure the required density. Internal vibrators shall be of appropriate size and shall penetrate only the layer covering the top surface of test specimen when moulded.
### Capping of Cylindrical Test Specimen

#### 4.2.1 Two to four hours after moulding, the cylindrical test specimens, if made in metal moulds, may be capped with a thin cap of neat cement paste.

The cap shall be formed by means of a piece of plate glass 6.5 mm thick, or a machined metal plate 12 mm thick and of a size 50 to 75 mm larger than that of mould the plate shall be worked on the cement paste until the plate rests on top of the mould. The cement for capping shall be mixed to a stiff paste 2 to 4 hours before it is to be used in order to avoid the tendency of the cap to shrink. Adhesion of the concrete to the top and bottom plates may be avoided by coating them with heavy oil or grease.

#### 4.2.2 If the cylindrical specimens are not capped with neat cement paste, they shall be capped before testing in such a manner that the ends are perfectly plane, and at right angles to the axis of the cylinder. The material used for capping and the thickness of the cap shall be such that it will not flow or fracture under the load.

#### 4.2.3 It is desirable that the capping material should have a value for modulus of elasticity equal to or greater than, that of the concrete under test.

### Curing and Storage of Test Specimens

#### 5.1 In order to afford reasonably uniform temperature and moist conditions during the first 24 hours for curing specimens and to protect them from damage, the moulds shall be covered with wet straw or gunny packing and placed in a storage box so constructed and kept in such a position on work that its air temperature when containing concrete specimens, shall remain between 22°C to 33°C. Other suitable means which provide such temperature and moisture conditions may be used.

**Note:** It is suggested that the storage box be made of 25 mm dressed tongued and grooved timber, well braced with battens to avoid warping. The box should be well painted inside and outside, and should be provided with a hinged cover and padlock.

The test specimens shall be removed from the moulds at the end of 24 hours and stored in a moist condition at a temperature within the range of 24°C to 30°C until the time of test. If storage in water is desired, a saturated lime solution shall be used.

### Method Testing

#### 6.1 The specimens shall be tested in accordance with procedure described under:

| 6.1.1 Method of Testing |  |
6.1.1.1 The tests shall be made at the age of the concrete corresponding to that for which the strengths are specified.

6.1.1.2 Compression tests shall be made immediately upon removal of the concrete test specimens from the curing room i.e. the test specimens shall be loaded in damp condition. The dimensions of the test specimens shall be measured in millimeters accurate to 0.5 mm.

6.1.1.3 The metal bearing plates of the testing machine shall be placed in contact with the ends of the specimens. Cushioning materials shall not be used. In the case of cubes the test specimens shall be placed in the machine in such a manner that the loads applied to the sides of the specimen as cast. An adjustable bearing block shall be used to transmit the load to the test specimen. The size of the bearing block shall be same or slightly larger than that of the test specimen. The upper or lower section of the bearing block shall be kept in motion as the head of the testing machine is brought to a bearing on the test specimen.

6.1.1.3.1 The load shall be applied axially without shock at the rate of approximately 140 kg/sq.cm. per minute. The total load indicated by the testing machine at failure of the test specimen shall be recorded and the unit compressive strength calculated in kg per sq.cm., using the area computed from the measured dimensions of the test specimen. The type of failure and appearance of the concrete shall be noted.

7. Standard of Acceptance

This shall be as per Clause 8.1.20.3 above.

ADDITIONAL TESTS FOR CONCRETE

In case the concrete fails when tested as per the method prescribed in preceding table above, one or more of the following check tests may be carried out at the discretion of Engineer to satisfy the strength of the concrete laid. All testing expenditure shall be borne by the Contractor. The number of additional tests to be carried out shall be determined by the Engineer. He shall be the final authority for interpreting the results of the additional tests and shall decide upon the acceptance or otherwise. His decision in this regard shall be final and binding. For purpose of payment the cube results only shall be the criteria. Some of the test outlined below:

1. Curing Cores: This method involves drilling and testing cores from the concrete for determination of compressing strength. In suitable circumstances the compressive strength of the concrete in the structure may be assessed by drilling cores from the concrete and testing. The procedure used shall comply with the requirements of IS: 1199-1959 and IS: 516-1959.

   The points from which cores shall be taken shall be representative of the whole concrete and at least three cores shall be obtained and tested. If the average of the strength of all the cores cut from the structure is less than the specified strength, the concrete represented by the cores shall liable to rejection and shall be rejected if a static load test (C-5) either cannot be carried out or is not permitted by the Engineer.

2. Ultrasonic Test: If an ultrasonic apparatus is regularly used by trained personal, and continuously maintained individual charts are kept showing a large number of readings; the relation between the reading
and strength of cubes made from the same batch of concrete, such charts may be used to obtain approximate indications of the strength of concrete in the structures. In cases of suspected lack of compaction or low cube strength, the results obtained from the ultrasonic test results on adjacent acceptable sections of the structures may be used for the purpose of assessing the strength of concrete in the suspected portion.

3. Rebound Hammer Test: If a rebound hammer is regularly used personal and continuously maintained individual charts are kept showing a large number of readings, the relation between the reading and strength of concrete cubes made from the same batch of concrete, such charts may be used in conjunction with hammer reading to obtain an approximate indication of the strength of concrete in a structure or element. If calibration charts are available from manufacturers it can be used. When making rebound hammer tests each result should be the average of at least six readings. Readings should not be taken within 25 mm of the edge of concrete members and it may be necessary to distinguish between reading taken on a troweled face and those on a moulded face. When making the tests on precast units, special case should be taken to bed them firmly against the impact of the hammer.

4. Load Test on Individual Precast Units: The load tests described in this clause are intended as a check on the quality of the units and should not be used as a substitute for normal design procedures. Where members require special testing such special testing procedures shall be in accordance with the specification. The test loads shall be applied and removed incrementally.

4.1 Non-Destructive tests: The unit shall be supported at its designed points of support and loaded for five minutes with a load equal to the sum of the characteristic dead load plus one and a quarter times the characteristic imposed load. The deflection is then recorded. The maximum deflection measured after application of the load shall be in accordance with the requirements defined by the Engineer. The recovery is measured five minutes after the removal of the load then reimposed. The percentages recovery after the second loading shall be not less than that after the first loading nor less than 90 percent of the deflection recorded during the second loading. At no time during the tests, shall the unit show any sign of weakness or faulty construction as defined by the Engineer in the light of a reasonable interpretation of relevant data.

4.2 Destructive tests: The units loaded while supported at its design point of support and must not fail at its design load for collapse, within 15 minutes of the time when the test load becomes operative. A deflection exceeding 1/40 of the test span is regarded as failure of the unit.

4.3 Special tests: For very large units or units not reading amenable to the above tests e.g. columns, the precast parts of composite beams and members designed for continuity or fixity, the testing arrangement shall be agreed upon before such units are cast.

5. Load test of structures or parts of structures

The test described in this clause are intended as a check on structures, where there is doubt regarding structural strength. Test loads are to be applied and removed incrementally.
5.1 Age of tests: The test is to be carried out as soon as possible after the expiry of 21 days from the time of placing of the concrete when the test is for a reason other than the quality of the concrete in the structure being in doubt, the test may be carried out earlier provided that the concrete has already reached its specified characteristic strength.

5.2 Test load: The test loads to be applied, for the limit states of deflection and local damage, are the appropriate design loads, i.e. the characteristic dead and superimposed loads. When the limit state of collapse is being considered the test load shall be equal to the sum of the characteristic dead load plus one and a quarter times the characteristic imposed load and shall be maintained for a period of 24 hours. If any of the final dead loads is not in position on the structure, compensating loads shall be added as necessary. During the tests temporary supports of sufficient strength to take the whole load shall be placed in position underneath but not in contact with the member being tested. Sufficient precautions must be taken to safeguard persons in the vicinity of the structure.

5.3 Measurements during the test: Measurements of deflection and crack width shall be taken immediately after the application of the load and, in the case of 24 h sustained load test, at the end of 24 h loaded period, after removal of the load and after the 24 h recovery period. Sufficient measurement shall be taken to enable side effects to be taken into account. Temperature and weather conditions shall be recorded during the tests.

5.4 Assessment of results: In assessing the strength of a structure, or a part of structure following a loading test, the possible effects of variation in temperature and humidity during the period of the test shall be considered.

The following requirements shall be met:

a) The maximum width of any crack measured immediately on application of the test load for local damage, is to be not more than 2/3 of the value of the appropriate limit state requirement.

b) For members spanning between two supports, the deflection measured immediately on application of the test load for deflection is to be not more than 1/500 of the effective span. Limits shall be agreed upon before testing cantilevered portions of structures.

c) If the maximum deflection in mm shown during a 24 h under load is less than 40 L2/D where L is effective span in m and D is the overall depth of construction in mm, it is not necessary for the recovery to be measured and the requirement (d) does not apply, and

d) If within 24 hours of the removal of the test load for collapse as calculated in clauses (a) a reinforced concrete structure does not show a recovery of at least 75 percent of the maximum deflection shown during the 24 h under load, the loading should be repeated. The structure should be considered to have failed to pass the rest if the recovery after the second loading is not at least 75 percent of the maximum deflection shown during the second loading.
The cement concrete shall be measured in cum. The slab shall be measured as running continuously through and the beam as a portion below the slab. The measurement shall be done separately as follows:

1) Foundations and plinths.
2) Walls including attached pilasters, buttresses, and their caps and bases and string courses etc.
3) Suspended beams, columns and pillars.
4) Kerbs, steps and the like.
5) String courses, copings, bed plates, anchor blocks, plain window sills and the like.
6) Small arched lintels not exceeding 1.5 m clear span over sailing copings and the like requiring form work to suspended portions.
7) Mouldings as in cornices window sills etc. exceeding 15 cm. in girth.
8) Mouldings as in cornices window sills etc. not exceeding 15 cm in girth.

No deductions shall be made for the following:

Small voids such as the shaded portions in Fig. 4 when each do not exceed 40 sq. cm. in section.

The work under following categories shall be measured separately:

i) From foundations to plinth level.
ii) From plinth level to floor two level;
iii) Form floor two level to floor three level and so on; and
iv) Concrete work in the parapet shall be measured together with the corresponding work in the wall of the storey next below.

The measurements shall be taken as given below:

The consolidated cubical contents of cement concrete shall be measured in cubic metres nearer to two places of decimal. Concrete laid in excess of sections shown in the drawing or as determined by the Engineer shall not be measured.

All measurements shall be taken to the nearest centimetre, except that thickness of slabs, partitions in case of posts, columns, beams and the like shall be taken to the nearest half centimetre.

No deductions shall be made for:

i) Ends of dis-similar materials (e.g. joists beams, posts girders, rafters, purlins, trusses, corbels and steps etc.) upto 500 sq.cm. in section; and
ii) Opening upto 0.1 sqm.

8.1.22 Rate
The rate is inclusive of the cost of labour and materials involved in all the operations described under various paras pertaining to this item. Contractor's profit @ 10% and over-head charges @ 5% has separately been added in the rates. In case water borne aggregates are used instead of crushed stone aggregates, the rates may be reduced as mentioned in the schedule.

Extra for additional lift over rates upto floor level two for all concrete work above floor level two, the rates as mentioned in the schedule of rates may be taken into consideration.

The rate for laying cements concrete:

a) in or under water excluding cost of pumping or bailing out water but including removing slush and;

b) in or under liquid mud including cost of removing slush etc. complete and;

c) in or under foul conditions,

shall be paid extra as mentioned in the latest applicable UKPWD Schedule of Rates.

8.2 Reinforced Cement Concrete

8.2.1 General

Reinforced cement concrete work may be cast-in-situ or precast as may be directed by the Engineer according to the nature of work. Reinforced cement concrete work shall comprise of the following, which may be paid separately or collectively as per description of the item of work.

(a) Form work.
(b) Reinforcement.
(c) Concreting.

8.2.2 Materials

8.2.2.1 Cement

The cement used for R.C.C. work shall comply with specification given in section 8.1.2.1 above.

8.2.2.2 Coarse Aggregates

The coarse aggregates used for R.C.C. work shall comply with specification given in section 8.1.2.2.1 above.

8.2.2.3 Fine Aggregates

Fine aggregates used for R.C.C work shall comply with specification given in section 8.1.2.2.2 above.
8.2.2.4 Water

Water used for R.C.C. work shall comply with specification given in section 8.1.2.3 above.

8.2.2.5 Cement Mortar

The cement mortar used for R.C.C. work shall comply with specifications as mentioned below, while the materials used in cement mortar shall be as per specifications under above sections 8.1.2.1, 8.1.2.2.1 and/or 8.1.2.2.2, and 8.1.2.3.

8.2.2.5.1 Mixing

The mixing of mortars shall be done in mechanical mixer. The Engineer, may, however, relax the condition at his discretion, taking into account the nature, magnitude and location of the work, practicability of the use of these machines etc. or where items involving small quantities are to be done or if, in his opinion, the use of these mixers is not otherwise feasible. In cases, where mixers are not to be used, the Contractor shall take prior permission of the Engineer in writing before the commencement of work.

8.2.2.5.1.1 Mixing in Mechanical Mixer

Cement and sand in the specified proportions shall be fed into the mixer and mixed dry thoroughly, in the mixer. Water shall then be added gradually and the wet mixing continued for at least 3 minutes after the addition of water. Care shall be taken, not to add more water than that which shall bring the mortar to the consistency of a stiff paste. Only that quantity of mortar, which can be used within 30 minutes of its mixing, shall be prepared at any time. When mixing is stopped, the stages of the machine shall be cleaned each time.

8.2.2.5.1.2 Hand Mixing

The requisite and measured quantity of sand shall be leveled on clean watertight masonry platform and cement bags emptied on top. The cement and sand shall be thoroughly mixed dry to a homogenous mixture of uniform colour by being turned over and over, backwards and forwards several times.

8.2.2.5.2 Re-tempering of Mortar

In case of mortar using cement, the mortar that has stiffened because of evaporation of water from the mortar, may be re-tempered by adding water as frequently as needed to restart the requirements of consistency but this re-tempering shall be permitted only upto two hours from the time of addition of cement. Mortar unused for more than 2 hours shall be rejected and removed from the site of work.

8.2.2.5.3 Freshness
As a rule, mortar shall be used on the day it is made. After the close of each day's work, mixing trough pans shall be thoroughly washed and cleaned. Mortars shall not be allowed to dry and shall be kept damp with wet sacks or by any other suitable means.

The quantity of dry mix, which can be used within 30 minutes, shall then be mixed in water-tight masonry troughs with just sufficient quantity of water to bring the mortar to the consistency of a stiff paste by hoeing back and forth for about 10 minutes after the addition of water.

8.2.2.5.4 Measurements
Mortars shall be measured in cubic metres.

8.2.2.5.5 Rate
The rate for mortar shall be inclusive of the cost of the materials and labour involved in all the operations. Carriage of one kilometer by mechanical transport and 100 Mtrs by head load has been taken into consideration.

The rates are exclusive of contractor's profit and overheads but include octroi, royalty etc. Water charges have not been allowed on the cost of the mortar under basic rates but this has been allowed in the analysis of complete item in which these mortars are used.

In addition to this, labour for measuring, carrying, depositing and mixing has been included in the rate.

8.2.2.6 Bitumen
Bitumen and bitumen products used for R.C.C. work shall comply with specifications given below.

8.2.2.6.1 General
According to IS: 334, Bitumen is defined as a Non- Crystalline Solid or Viscous material having adhesive properties, derived from Petroleum either by natural or refinery process substantially soluble in Carbon Di-sulphide. Bitumen are Black or Brown in colour. They may occur naturally but are usually made as end products from distillation of or as extract from Selected Petroleum Oils.

Bitumen obtained from distillation of crude petroleum is known as “straight-run” bitumen. When straight-run bitumen is further treated by blowing air through it, it attains a rubbery consistency and is known as “blown” bitumen. When straight-run bitumen is blended with a volatile or party volatile solvent, it is known as “Cut-back” bitumen. The straight-run bitumen emulsified with water is called “bitumen-emulsion.”
8.2.2.6.2 Types and Specifications

Some relevant bitumen types and specifications are given below. For any details of other bitumen work related materials.

8.2.2.6.2.1 Bitumen Pre-moulded Joint Filler

It shall conform to IS: 1838-1983 (Part 1) & IS: 1838-1984 (Part 2) and in which the details regarding performed fillers for expansion joints in concrete non-extruding and resilient type (Bitumen-Impregnated-fibre) has been given. It specifies requirement and tests for material, manufacturing, recovered, compression, extrusion, weathering, penetration and recovered bitumen, dimension and Bitumen content. The thickness shall be 12 mm, 18 mm or 25 mm as specified and shall be of maximum available standard length. During the casting of the slab, Pre-Moulded joint filler shall be placed adequately in position against the finished end of concrete slab. The filler shall remain 20 mm below the top surface of the pavement and shall expand up to the sub-grade.

Fibre used may be of soft board, fibre board or other suitable fibre (natural or artificial) of cellular nature and shall be securely bonded together and uniformly impregnated bitumen.

8.2.2.7 Steel

The steel shall be clean and free from loose rust and loose mill scale at the time of fixing in position and subsequent concreting.

Reinforcement shall not be bent or straightened in a manner likely to injure the material or reduce the section. Bars, with kinks or bends not shown on the drawings shall not be used. The reinforcement shall be bent cold. For bars of 40 mm dia. and above, the bending may be permitted by heating bars to a cherry red stage (temperature not exceeding 845°C or 1550°F, but it is imperative that hot bar should be allowed to cool slowly, quenching or immersion in water otherwise being prohibited.

The steel uses for R.C.C. work shall conform to specifications given below.

8.2.2.7.1 General

8.2.2.7.1.1 The following types of steel for reinforcement shall be used in reinforced concrete/pre-stressed concrete construction and these shall conform to Indian Standard as revised from time to time as mentioned against each.

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Types of Steel Product</th>
<th>Indian Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>a)</td>
<td>For ordinary reinforced concrete work.</td>
<td></td>
</tr>
</tbody>
</table>
### Types of Steel Product and Indian Standards

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Types of Steel Product</th>
<th>Indian Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Mild steel and medium tensile steel bar and hard drawn steel wire for concrete reinforcement.</td>
<td>IS: 432-1982</td>
</tr>
<tr>
<td>2.</td>
<td>Deformed bars of concrete reinforcement, hot rolled mild steel and medium tensile steel.</td>
<td>IS: 1139-1966</td>
</tr>
<tr>
<td>5.</td>
<td>High tensile steel bar for pre-stressed concrete.</td>
<td>IS: 2090-1983</td>
</tr>
<tr>
<td>b)</td>
<td>For Pre-stressed concrete work.</td>
<td></td>
</tr>
</tbody>
</table>

8.2.2.7.1.2 The composition of steel shall conform to IS: 226-1975.

8.2.2.7.1.3 Steel shall be supplied by the department, where so stipulated in the Contract. But where Contractor has to arrange these steel products he shall produce to the Engineer a copy of the manufacturer’s test certificate, indicating the Indian Standard to which the particulars steel conforms and the grade if any before it is incorporated in the work.

8.2.2.7.1.4 Standard Size

The standard nominal size specified in IS: 432-1982 for mild and medium tensile steel bars shall be as follows:

Diameter of round bars or side of square bars – 5, 6, 8, 10, 12, 15, 20, 22, 25, 28, 32, 36, 40, 45 and 50 mm.

There is no objection to the use of bars of other sizes provided they comply with the physical, chemical and other requirements laid down in IS: 432-1982 (Part 1).

In the case of deformed bar, the nominal size is defined as that equivalent to the diameter or side of a plain bar having the same weight per meter run as the deformed bar.

8.2.2.7.2 Mild Steel

8.2.2.7.2.1 The physical requirements for mild steel, grade-I and II, and medium tensile steel bars are mentioned in table below.

8.2.2.7.2.2 Physical Properties of Bars
### S. No. Property Nominal size of bars Mild Steel Medium Tensile Steel

<table>
<thead>
<tr>
<th></th>
<th>Ultimate tensile stress, kg/mm²</th>
<th>All sizes.</th>
<th>Gr. I</th>
<th>Gr. II</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td></td>
<td></td>
<td>42</td>
<td>38</td>
<td>55</td>
</tr>
</tbody>
</table>

|   | Yield stress, kg/mm² (Min.) For bars up to and including 20 mm. |             | 26    | 23.5   | 36 |
| 2. |                                                                | For bars over 20 mm up to and including 40 mm. | 24    | 21.5   | 34.5 |
|   |                                                                | For bars over 40mm. | 24    | 21.5   | 33  |

|   | Elongation, percent (Min.) on gauge length 5.65, so where is the cross sectional area of the test piece. For bars under 10 mm. |             | 20    | 20     | 17 |
| 3. | For bars 10 mm and over. |                                                        | 23    | 23     | 20  |

**Note:**

1. Mild steel grade-II is available in two varieties designated as ST-42-0 and ST-32-0. ST-42-0 only shall be used subject to the above conditions. ST-32-0 shall not be used as reinforcement.

2. Grade-II mild steel bars shall not be used in the following conditions:
   
   i. Where the structures are located in earthquake zones subject to severe damage.
   
   ii. Where the structures are subjected to dynamic loading (other than wind loading) such as railway and highway bridges.
   
   iii. Where welding has to be employed for fabrication.
   
   iv. Where the design of the structures has been based on plastic theory.

3. Mild steel off grade: This variety of steel is not of uniform quality. Whenever this is to be used it should be subject to ultimate tensile strength and bending tests.

**Weight:** The tolerance on weight for round and square bars shall be the following percentage of the weight calculated on the basis that steel weighs \(0.785\) kg/cm² of cross-sectional area per meter run.

<table>
<thead>
<tr>
<th>Nominal Size</th>
<th>Tolerance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upto and including 8.0 mm</td>
<td>± 4 percent</td>
</tr>
<tr>
<td>Over 8.0 mm</td>
<td>± 2.5 percent</td>
</tr>
</tbody>
</table>

**Tests:** Unless otherwise specified, the requirements of IS: 226-1975 shall apply. All test pieces of bars shall be selected by the Engineer or his authorized representative either:
Section 6 - Works Requirements

8.2.2.7.2.3 Hot Rolled Deformed Bars

The hot rolled mild steel and medium tensile steel deformed bars shall conform to IS: 1139-1966. The bars are provided with lugs, ribs or deformation on the surface of the bar to minimize the slippage of the bar in concrete when hot rolled from the steel billets.

The physical requirements are mentioned in table below.

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Property</th>
<th>Nominal size of bars</th>
<th>Mild Steel bars</th>
<th>Medium Tensile Steel bars</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Ultimate tensile stress, kg/mm²</td>
<td>All sizes.</td>
<td>42</td>
<td>55</td>
</tr>
<tr>
<td>2.</td>
<td>Yield stress, kg/mm² (Min.)</td>
<td>For bars up to and including 20 mm.</td>
<td>26</td>
<td>36</td>
</tr>
<tr>
<td></td>
<td></td>
<td>For bars over 20 mm up to and including 40 mm.</td>
<td>24</td>
<td>34.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>For bars over 40 mm.</td>
<td>24</td>
<td>33</td>
</tr>
<tr>
<td>3.</td>
<td>Elongation percent, (Min.) on gauge length 5.65, so where is the cross sectional area of the test piece.</td>
<td>-</td>
<td>23</td>
<td>20</td>
</tr>
</tbody>
</table>

Weight: The tolerance on weight for round and square bars shall be the following percentage of the weight calculated on the basis that steel weighs 0.785 kg/cm² of cross-sectional area per meter run.

| Nominal Size                  | Tolerance  
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Upto and including 8.0 mm</td>
<td>± 4 percent</td>
</tr>
<tr>
<td>Over 8.0 mm</td>
<td>± 2.5 percent</td>
</tr>
</tbody>
</table>

Tests:
Tensile test  This shall be done as per IS: 1139-1966.
Bend Test    This shall be done as per IS: 1599-1985.
Re-test      This shall be done as per IS: 1139-1966.

8.2.2.7.2.4 Other Structural Steel sections

(i)  M.S. Flats and Plates
     This shall conform to IS: 1730-1989.

(ii) Angle Iron Tee Joists and Channels
     This shall conform to IS: 808-1989.

8.2.2.7.2.5 Holding Down Bolts

(i)  Holding down bolts (upto 0.50m)

(ii) Holding down bolts (beyond 0.50m length).

Anchor bolts shall be placed in the concrete foundations. These should be held in positions with a wooden template. The anchor bolts shall be provided with suitable timber mould or pipe sheave to allow for adjustment. The timber mould or pipe shall be removed after initial set of concrete. The spaces left around anchor bolts shall have a sloping channel leading to the side of the pedestal and on the underside of the base plate to allow the spaces being grouted up after the base plate is fixed in the position along with column footing. Grouting shall be of cement mortar 1:3 (1 cement : 3 coarse sand) or as specified.

8.2.2.7.2.6 Rivets

Rivets shall be manufactured from rivet–bars of mild steel conforming to specification given in IS: 1148-1982. These rivets shall have snap head, flat counter sunk head, rounded counter sunk head or pan head as shown in drawing or as directed by the Engineer.

8.2.2.7.2.7 Bolts and Nuts

(a) Black Bolts: Also known as machine bolts, these bolts shall be made from rods and they come from the rolling mills and are not finished to exact size. A lower working stress is taken for these types of bolts than those of rivets and ‘turned and fitted bolts’.

(b) Turned and Fitted Bolts: These bolts shall be made in an automatic lathe machine which turns the bolts to exact diameter for these bolts the same suitable stress are allowed as for rivets.

All bolt heads and nuts shall be hexagonal and of equal size, unless specified otherwise. The screwed threads shall conform to IS: 1363-2002 and the threaded
surface shall not be tapered. The bolts shall be of such length as to project two clear threads beyond the nuts when fixed in position, and these shall fit in the holes without any shake. The nuts shall fit in the threaded ends of bolts properly.

Where turned and fitted bolt are required to be used in place of rivets, these shall be provided with washers not less than 6 mm thick, so that the nut when tightened, shall not bear on the unthreaded body of the bolt. Tapered washers shall be provided for all heads and nuts bearing on leveled surfaces. The threaded portion of the bolt shall not be within the thickness of the parts bolted together. The faces of bolt heads and nuts abutting against steel members shall be machine finished.

Where there is risk of the nuts being removed or becoming loose due to vibration or reversal of stresses, these shall be secured from slackening by the use of lock nuts, spring washers, cross cutting or hammering down of threads as directed by the Engineer.

The nominal length of the bolt shall be of the distance from the underside of the head to the head to the further end of the shank. The nominal diameter of the bolt shall be the diameter at the shank above the screwed threads.

Bolts, nuts and washers shall be thoroughly cleaned and dipped in double boiled linseed oil before use.

8.2.2.7.2.8 Tor Steel (Round)

Cold Twisted Bars shall conform to IS: 1786-2008. The physical properties for all sizes of twisted bars, whether plain or deformed are mentioned below:

<table>
<thead>
<tr>
<th></th>
<th>Tensile strength, kgf/mm², (Min.)</th>
<th>49.5</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.</td>
<td>0.2 percent proof stress kgf/mm² (Min.)</td>
<td>42.5</td>
</tr>
<tr>
<td>3.</td>
<td>Elongation, percent (Min.) on gauge length 5.65, so where is the cross sectional area of the test piece.</td>
<td>14.5</td>
</tr>
</tbody>
</table>

*Weight*: The tolerance on the weight of bars shall be the following percent – age of the weight calculated as above:

<table>
<thead>
<tr>
<th>Nominal Size</th>
<th>Tolerance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upto and including 8.0 mm</td>
<td>± 4 percent</td>
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<tr>
<td>Over 8.0 mm</td>
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</tr>
</tbody>
</table>

*Tests*: Selection and preparation of test samples, unless otherwise specified in this standard, the requirements of IS: 226-1975 shall apply. All test pieces shall be selected by the Engineer or his authorized representative either:

i) From the cuttings of bars, or
ii) If he so desires, from any bar after it has been cut to the required or specified size and the test piece taken from any part of it.

The test piece obtained in accordance with as above shall be full sections of the bars, as rolled and subsequently cold worked and shall be subjected to physical tests without any further modifications. No reduction in size by machining or otherwise shall be permissible. No test piece shall be annealed or otherwise subjected to best treatment. Any straightening which a test piece may require shall be done cold.

<table>
<thead>
<tr>
<th>Test Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tensile test</td>
<td>This shall be done as per IS: 226-1975 and IS: 1608-2005.</td>
</tr>
<tr>
<td>Bend Test</td>
<td>This shall be done as per IS: 1599-1985.</td>
</tr>
<tr>
<td>Re-bend test</td>
<td>This shall be done as per IS: 1786-2008.</td>
</tr>
<tr>
<td>Re-test</td>
<td>This shall be done as per IS: 1786-2008.</td>
</tr>
</tbody>
</table>

8.2.2.7.2.9 Storage of Reinforcement

Steel reinforcement shall be stored in such a way as to avoid distortion and prevent deterioration from corrosion. Where directed, the reinforcing bars shall be given a cement wash before stacking to prevent scale and rust.

Any reinforcement which has deteriorated or corroded or is considered defective by the Engineer shall not be used in the work.

8.2.2.7.2.10 Mode of Measurements

All the products of steel as mentioned in Clause 8.2.2.7.2 above shall be measured in ‘quintals’.

8.2.3 Technical Specifications

8.2.3.1 Bending of Reinforcement

Reinforcing steel shall conform accurately to the dimensions given in the Bar Bending Schedules shown on relevant drawings.

Bars shall be bent cold to the specified shape and dimensions or as directed by the Engineer using a proper bar bender, operated by hand or power to attain proper radius of bends.

Bars shall not be bent or straightened in a manner that will injure the material.

Bars bent during transport or handling shall be straightened before being used on work, they shall not be heated to facilitate bending, unless permitted by Engineer.

Unless otherwise specified, a U-type hook at the end of each bar shall invariably be provided. The radius of the bend shall not be less than twice the diameter of the round bar and the length of the straight part of the bar beyond the end of the curve
shall be at least four times the diameter of the round bar. In the case of bars which are not round and in the case of deformed bars, the diameter shall be taken as the diameter of a circle having an equivalent effective area.

The hook shall be suitably encased to prevent any splitting of the concrete.

A sketch of hook as shown as below:

**Standard Hook**

![](image)

**8.2.3.2 Placing of Reinforcement**

All reinforcing bars shall be accurately placed in exact position shown on the drawings, and shall be securely held in position during placing of concrete by annealed binding wire not less than 1 mm in size and conforming to IS: 280 and by using stays blocks or metal chairs, spacers, metal hangers, supporting wires or other approved devices at sufficiently close intervals. Bars will not be allowed to sag between supports or displaced during concreting or any other operation over the work. All devices used for positioning shall be of non-corrodible material. Wooden and metal supports will not extend to the surface of concrete, except where shown on the drawings. Placing bars on layers of freshly laid concrete as the work progresses for adjusting bar spacing will not be allowed. Pieces of broken stone or brick and wooden blocks shall not be used. Layers of bars shall be separated by spacer bars, precast mortar blocks or other approved devices.

Reinforcement after being placed in position shall be maintained in a clean condition until completely embedded in concrete. Special care shall be exercised to prevent any displacement of reinforcement in concrete already placed.

To protect reinforcement from corrosion, concrete cover shall be provided as indicated on the drawings. All bars protruding from concrete and to which other bars are to be spliced and which are likely to be exposed for an indefinite period shall be protected by a thick coat of neat cement grout.
In the case of columns and walls, vertical bars shall be kept in normal position with timber templates having slots accurately cut in for bar position. Such templates shall be removed after the concreting has progressed up to level just below them.

Bars crossing each other, where required, shall be secured by binding wire (annealed) of size not less than 1 mm and conforming to IS: 280 in such a manner that they do not slip over each other at the time of fixing and concreting.

As far as possible, bars of full length shall be used. In case this is not possible, overlapping of bars shall be done as directed by the Engineer. When practicable overlapping bars shall not touch each other, but be kept apart by 25 mm or 1¼ times the maximum size of the coarse aggregate whichever is greater, by concrete between them. Where not feasible, overlapping bars shall be bound with annealed steel wire, not less than 1 mm thickness twisted tight. The overlaps shall be staggered for different bars and located at points, along the span where neither shear nor bending moment is maximum.

8.2.3.3 Laps in Bars

The length of lap in bars shall not be less than:

(a) For bars in tension:

<table>
<thead>
<tr>
<th>Bar diameter</th>
<th>Permissible stress</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Four times the bond stress given in table IS: 456 or 30 bar diameter, whichever is greater.</td>
</tr>
</tbody>
</table>

(b) For bars in compression:

<table>
<thead>
<tr>
<th>Bar diameter</th>
<th>Permissible stress</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Five times the bond stress given in table IS: 456 or 24 bar diameter, whichever is greater.</td>
</tr>
</tbody>
</table>

8.2.3.4 Distances between Reinforcement Bars

(a) The distance between two parallel reinforcement bars shall be except as provided under (b) not less than the greatest of the following three distances:

i) The diameter of either bar, if their diameters be equal.

ii) The diameter of the larger bar, if the diameter be unequal.

iii) 6 mm more than the nominal maximum size of the coarse aggregate comprised in such concrete.

Note: A greater distance should be provided when convenient.

(b) The vertical distance between two horizontal main steel reinforcements, or the corresponding distance at right angles to two inclined main steel reinforcements shall be not less than 13 mm except at a splice or lap and except where one of such reinforcements is transverse to the other;
(c) The pitch of the main bars in a reinforced concrete solid slab shall not be more than four times the effective depth of such slab.

(d) The pitch of distributing bars in a reinforced concrete solid slab shall not be more than four times the effective depth of such slab.

8.2.3.5 Cover

Reinforcement shall have concrete cover, and the thickness of such cover (exclusive of plaster of other decorative finish) shall be as follows:

(a) at each end of a reinforcing bar not less than 25 mm nor less than twice the diameter of such rod or bar;

(b) for a longitudinal reinforcing bar in a column not less than 38 mm, nor less than the diameter of such rod or bar. In the case of columns of minimum dimension of 20 cm or under, whose bars do not exceed 13 mm diameter, 25 mm cover may be used;

(c) for a longitudinal reinforcing bar in a beam not less than 25 mm nor less than the diameter of such rod or bar;

(d) for tensile, compressive, shear or other reinforcement in a slab, not less than 13 mm nor less than the diameter of such reinforcement; and

(e) for any other reinforcement, not less than 13 mm nor less than the diameter of such reinforcement.

(f) for all external work, for work against earth faces, and also for internal work where there exist particularly corrosive conditions, the cover of the concrete shall be increased by 13 mm over and above the figures given under (a) to (e) above.

Note: In case of rafts where resting on soil directly or on lean concrete, the cover for reinforcement shall not be less than 75 mm or as mentioned in the drawings.

8.2.3.6 Distribution, Shrinkage Temperature Reinforcement

Reinforcement for distribution and shrinkage and temperature stresses normal to the principal reinforcement shall be provided in floor and roof slabs where the principal reinforcement extends in one direction only. The area of such reinforcement shall be not less than 0.2 percent of the sectional area of concrete and in no case shall the pitch of such reinforcing bars be greater than (a) 4 times the effective thickness of slab, or (b) 0.6 m whichever is smaller. In case floor and roof slabs are exposed to sun, such steel shall not be less than 0.4 percent. The reinforcement shall be provided as per drawing.

8.2.3.7 Reinforcement position, stirrups position, stirrups spacing & off sets in compression reinforcement
8.2.3.7.1 Transverse reinforcement shall be placed on the neutral axis side of the longitudinal reinforcement, and on the inner side of any curve in the longitudinal reinforcement.

8.2.3.7.2 Stirrups shall have their ends hooked at the position of anchorage. The tensile reinforcement shall be within the loop of the stirrup and securely fastened thereto.

8.2.3.7.3 The spacing of stirrups shall not exceed a distance equal to the lever arm of resisting moment.

8.2.3.7.4 Where changes in the cross section of a compression member occur, the longitudinal reinforcement bars shall be slopped for the full length of the member or offset in a region where lateral support is afforded. Where offset, the slope of the inclined portion from the axis of the member shall not be more than 1 in 6.

8.2.3.8 Effective Diameter of a Bar

For purposes of this section, the effective diameter of a reinforcement bar shall be calculated as below:

a) For a bar, the cross-sectional area of which is constant along its length and in the case of deformed bars, the pattern of deformation of which is such that by visual inspection the cross-sectional area is substantially uniform along the length of the bar, the effective diameter is that of a circle having the same area as the cross section of the bar.

b) For a bar, the cross-sectional area of which varies along its length, the effective diameter is that of a circle having an area equal to the least area of any cross section of the bar excluding deformation ribs. An allowance not exceeding 3 percent may, however, be added to the least area of the cross section on account of the ribs or any non-continuous sides or both.

8.2.3.9 Coupling and Welding of Bar

Whenever indicated on the drawings or desired by the Engineer, bars shall be joined by couplings which shall have a cross-section sufficient to transmit the full strength of bars. The ends the bars that are joined by coupling shall be upset for a sufficient length so that the effective cross-section at the base of threads is not less than the normal cross-section of the bar. The threads shall be standard whiteworth threads. Steel for coupling shall conform to IS: 226.

When premised or specified on the drawings joints of reinforcement bars shall be butt-welded so as to transmit their full strength. Welded joints shall preferably be located at points where steel will not be subject to more than 75 percent of the maximum permissible stresses and welds so staggered that, at any one section, not more than 20 percent of the rods are welded. Only electric arc welding using a
process which excludes air from the molten metal and conforms to any or all other special provisions for the work will be accepted. Suitable means shall be provided for holding the bars securely in position during welding. It must be ensured that no voids are left in welding and when welding is done in 2 or 3 stages, previous surface shall be cleaned properly. Ends of the bars shall be cleaned of all loose scale, rust, grease, paint and other foreign matter before welding. Only, competent welders shall be employed on the work.

The M.S. electrodes used for welding shall conform to IS: 814.

Welded pieces of reinforcement shall be tested. Specimens shall be taken from the actual site and their number and frequency of tests shall be as directed by the Engineer.

8.2.3.10 Fire Resistance

Where fire resistance is an important feature of the design, the concrete cover may have to be increased; such increase depends upon the quality of aggregate and upon the severity and duration of the possible fire to which the structure may be subjected. Aggregates having low co-efficient of expansion e.g. formed slag, blast furnace slag, crushed brick aggregate, well-burnt clinker and lime stone are desirable for the fire protection. The siliceous aggregates e.g. flint, gravel, granite and other crushed natural stones other than lime stone should not be used where fire hazard is greater, because the quartz of which they largely consist has high co-efficient of expansion and, under heat, will expand and crack the concrete exposing the reinforcement to direct heat.

8.2.3.11 Stresses in Steel Reinforcement

For this, reference may be made to relevant IS Codes.

8.2.3.12 Tying and Positioning

Reinforcement shall always be accurately positioned and secured against displacement by tying with soft iron wire of not less than 1.00 mm and shall be supported in position clear of the forms, by concrete or metal chains or spacers or by metal hangers.

8.2.3.13 Future Bonding and Substitutions

Exposed reinforcement bars intended for bonding with future extensions shall be protected from corrosion.

Substitution of bars of different sizes than specified will be permitted only if authorized by the Engineer. If steel is substituted, it shall have an area equivalent to
the design area or large, provided further that the safe bond stress is not exceeded,
and also the effective depth is not less that provided in the design.

8.2.3.14 Splices
As far as possible, bars of full length shall be used. Splicing of bars except where
such is shown on the plan will not be permitted without the approval of the Engineer.
Splices shall be staggered and shall not be made at points of maximum stress.

8.2.3.15 Relative Positions
Tensile reinforcement shall always be placed within the loop of stirrups and shall be
securely fastened thereto. Stirrups shall have their ends hooked at the position of
anchorage. Transverse reinforcement shall always be placed on the neutral axis
side of the longitudinal reinforcement, and on the inside of any bend in it.

8.2.3.16 To Conform to the Drawings
Reinforcement shall be carefully formed to the dimensions and positions indicated
on the drawings or as directed by the Engineer.

8.2.4 Form Work
The form work shall be done as per specification described in Section 7 above.

8.2.5 Inspection
Full details of the numbers, sizes, lengths, weights, laps, welds, spacing of bars
places in position in different parts of the work shall be recorded, certified and
signed by the Engineer to show that all reinforcement has been placed correctly as
per the sanctioned drawing or as ordered by the Engineer in writing before placing
concrete. No concrete shall be deposited until the Engineer has inspected and
certified the correctness of reinforcement, recorded the steel reinforcements and
given permission to place the concrete in writing. After the approval of reinforcement
by the Engineer, it will be the contractor's responsibility to see that the reinforcement
spacing and arrangements are not tampered with in any way before concreting.

8.2.6 Concreting

8.2.6.1 Concrete
Concrete mix shall be as specified, and it shall conform to the relevant specifications
for cement concrete. Concrete shall be mixed by mechanical mixers. The Engineer
may, however, permit hand mixing under special circumstances by an order in
writing.

8.2.6.2 Consistency
For reinforced cement concrete work the general requirement is that the concrete shall flow sluggishly into the forms and around the reinforcement without any segregation of coarse aggregate from the mortar and fill the form work completely without forming honey-combed concrete mass. The degree of consistency, which shall depend on the nature of work and whether the concrete is vibrated or hand tamped, shall be determined by slump/Vee Bee Consistometer test as given in section 8.1.10 above.

8.2.6.3 Strength of Concrete

Reference may be made to Clause No. 8.1.4 above.

8.2.6.4 Placing of Concrete

Concrete shall only be commenced after the Engineer has inspected the form work and reinforcement as placed and passed the same. Form work shall be clean and free from all shavings, saw-dust, pieces of wood, or other foreign material, and shall be treated as described under section 7 'Form Work' above.

The concrete shall be gently deposited (and not thrown) as nearly as practicable, in its final position to avoid re-handling and shall be so deposited that segregation of aggregates does not occur. In deep trenches and footings concrete shall be placed though chutes as directed by the Engineer. In case of columns and walls, formwork shall be so adjusted that the vertical drop of concrete is not more than 1.5 metres.

In case of concreting of slab and beams, wooden, plank cat-walks supported directly on the form work by means of wooden blocks or logs shall be provided to convey the concrete to the place of deposition, so as not to disturb the reinforcement in anyway. No one shall be allowed to walk over the reinforcement.

In case of columns and walls, it is desirable to place concrete in full height in one operation, so as to avoid construction joints, but the rate of concreting in the vertical direction shall be restricted to one metre per hour.

It is necessary that the time between mixing (adding water) and placing of concrete shall not exceed 20 minutes so that the initial setting process is not interfered with.

Concreting, one commenced, shall be carried on continuously to completion useless otherwise directed.

During cold weather, concreting shall not be done when the temperature falls below 4.5°C. The concrete placed shall be protected against frost by suitable covering. Concrete damaged by frost shall be removed and work redone. During hot weather, precautions shall be taken to see that the temperature of wet concrete does not
exceed 38°C. No concrete shall be laid within half an hour of the closing time of the
day, unless permitted by the Engineer.

All bars projecting from piers, columns, beams, slabs etc. to which other bars and
concrete are to be attached or bounded to later on, shall be protected with a coat of
thin neat cement grout if the bars are not likely to be incorporated with the
succeeding mass of concrete within the following 10 days. This coat of thin neat
cement shall be removed before concreting.

8.2.6.5 Compaction

(a) The concrete shall be thoroughly compacted as the depositing proceeds by
means of a suitable type of vibrators to get a dense concrete. The vibrators shall
maintain the whole concrete under treatment in an adequate state of agitation,
such that declaration and effective compaction is attained at a rate
commensurate with the supply of concrete from the mixers. The vibration shall
continue during the whole period occupied by placing of concrete, the vibrator
being adjusted so that the centre of vibration approximates to the centre of the
mass being compacted at the time of placing.

The Engineer may relax this condition of using vibrators at his discretion for
certain items, depending on the thickness of the members and feasibility of
vibration the same. For items, where the vibrators are not be used, it shall be the
duty of the connector, to take the prior permission of the Engineer in writing
before the start of the work. In circumstances, the concrete when laid in its final
position shall be panned or tamped in thickness not exceeding 15 cm (confined
to only 7.5 cm when working in the vicinity of reinforcement bars). Compaction
shall be arrived out by skilled workmen with hammers and rods. It shall be
continued until the concrete is thoroughly consolidated and is in perfect contact
with reinforcement. The concrete shall be worked to the face of the forms.
Special care shall be taken to ensure that the concrete is worked well into the
bottom of all cavities and also to prevent distortion of rods while ramming around
them and particularly to avoid pressing the rods close to form work.

(b) Concrete shall be judged to be compacted when the mortar fills the spaces
between the coarse aggregate and begins to cream up to form an even surface.
When this condition has been attained the vibration shall be stopped in case of
vibrating tables and external vibrators, and needle of vibrators, withdrawn slowly
at the rate of 15 cm per minute in case of internal vibrators. The internal vibrators
shall first be withdrawn at the rate of 15 cm per minute after which the external
vibrators shall be stopped so that no depression is left in the body of the
The maximum task of the vibrator shall be the compaction of 1.88 cubic metres of concrete per hour per kilo watt (kw) rating of the vibrator. The specific instructions of the makers of the particular type of vibrator used shall be strictly complied with.

Compactions shall be completed before the initial setting starts i.e. within 30 minutes of addition of water to the dry mixture. During compaction it shall be ensured that the needle vibrators are not applied on reinforcement which is likely to destroy the bond between concrete and reinforcement.

8.2.6.6 Joints

Joints shall be provided as shown in the drawings or as directed by the Engineer.

8.2.6.6.1 Construction Joint

For large works, where it is not practicable to carry on concreting continuously, the position of leaving off points or construction joints and the details of which shall be shown in the drawings or as indicated in Fig. 5 or as directed by the Engineer. Such joints shall be kept to the minimum and shall not be located in valleys. The joints shall be kept at places where the shear force is the minimum and these shall be straight and at right angles to the direction of main reinforcement. In case of columns the joints shall be horizontal and 10 to 15 cm below the bottom of the beam running into the column head and the portion of the column between the stepping off level and the top of the slab shall be concreted with the beam.

When stopping the concrete on a vertical plane in slab and beams, an approved stop-board shall be placed with necessary slots for reinforcement bars to pass freely without bending or any other obstruction. The construction joint shall be keyed by providing a triangular or trapezoidal filled nailed on the stop-board. Inclined or feather joints shall not be permitted. Any concrete following through the joints of stop-board be removed soon after the initial set. When concrete is stopped on a horizontal plane, the surface shall be roughened and cleaned after the initial set.

Walls shall be left off at any convenient height but the last layer shall be at the same level all-round the structure.

When the work has to be resumed, on a surface which has hardened (i.e. more than 48 hours old), the joint shall be thoroughly cleaned with wire brush and loose particles removed. It shall then be covered with a 13 mm layer of freshly mixed mortar comprising of cement and coarse sand in the same ratio as the cement and coarse sand in the concrete mix shall be applied before fresh concrete is laid.
When the work has to be resumed on a surface, which has not fully hardened (i.e. less than 48 hours old) the joint shall be thoroughly cleaned with wire brush and loose particles removed. The surface shall first be thoroughly wetted and all free water removed. A coat of neat cement slurry at the rate of 2.75 kg of cement per square metre shall then be applied on the roughened surface before fresh concrete is laid.

8.2.6.6.2 Expansion Joint

Expansion joints shall be provided as directed by the Engineer. The filling of these joints with bitumen filler, bitumen felt or any such material and the provision of copper or brass plate etc. (as may be specified) shall be described and paid for separately.

8.2.6.6.3 Joints in Floors

Construction joints in floors shall be located near the middle of spans of slabs, beams, or girders, unless a beam intersects a girder that shall be offset a distance equal to twice the width of the beam. Adequate provision shall be made for shear by use of inclined reinforcement.

8.2.6.6.4 Joints in Columns

Joints in columns shall be made at the underside of the floor. Haunches and column capitals shall be considered as continuous with, and part of the floor.

8.2.6.6.5 Expansion Joints in Long Structures

Structures exceeding 46 m in length shall be divided by one or more expansion joints. Structures in which marked changes in plan dimensions, take place abruptly shall be provided with expansion joints at the sections where such changes occur. Length of a structure where expansion joint has to be provided shall be determined after taking into consideration various factors, such as temperature, exposure, to weather, the time and season of the laying of the concrete etc. Under no circumstances shall be structure of 46 m or more be without an expansion joint.

8.2.6.6.6 Expansion Joints in Bridges

Wherever expansion joints are provided in the main structure of a bridge, expansion joints must be provided in the concrete flooring immediately above them, such joints should be constructed with two sheets of tarred paper previously laid on the support and be filled with preformed plastic material 13 mm thick which should be placed in the forms before concrete is laid so as to give a projection above the top surface of the concrete; this projection being trimmed of flush with the surface after the concrete has set.
8.2.6.6.7 Continuous Work Joints to be at Contractor’s Cost
Concrete shall be deposited continuously and as rapidly as practicable, until the unit of operation, approved by the Executive Engineer, is completed. Construction joints, as at points not provided for in the drawings shall therefore be deemed to be for the convenience of the Contractor and special work entailed shall be carried out by him within the rate.

8.2.6.6.8 Construction Joints Position
Where construction joints are unavoidable, concreting must be stopped as near as possible at the centre of beams or slabs and not over the support, in order to make joint whose plane in normal to the principal lines of stress and at right angles to the span. Construction joints shall coincide with structural joints wherever possible. If made elsewhere, they shall be so located and made to impair the strength and/or appearance of the structure in the least possible manner. Construction joints are subject to the approval of the Executive Engineer with respect to their position, number and construction.

8.2.6.6.9 Horizontal Joints
Where resistance to horizontal shear is essential, a key shall be formed by partially embedding reinforcing rods, or by forming mortices in the concrete.

8.2.6.6.10 Sliding Joints
When sliding joints are called for on the plans, the seat of the sliding joint shall be finished to a smooth plane surface and allowed to harden. The seat shall be covered with the required thickness of bituminous material or otherwise treated as specified on the plans or as directed by the Engineer.

8.2.6.6.11 Concreting under Water/Extreme Weather Conditions
For this, reference may be made to Clause 8.1.14 and 8.1.15 above.

8.2.6.7 Finishing
(a) In case of roof slabs the top surface shall be finished even and smooth with wooden trowel, before the concrete begins to set.

(b) The surface that becomes exposed on the removal of forms shall be examined by the Engineer, before any defects are made good. Projections due to defective workmanship on the concrete surface shall be removed by careful chiselling work that has sagged or bulged out, or contains honey-combing shall be rejected. Honey-combing of minor nature shall be accepted. Where so stated in the description of the item, the exposed surface of R.C.C. work shall then be
plastered or rendered with cement mortar 1:3 (1 cement: 3 fine sand) to give a smooth and even surface true to line and form.

Note: The tops of slabs, treads and landings, faces of risers in stairs and vertical faces of lintels shall not be considered as exposed surface.

Where the exposed surface is to be finished otherwise than plastering with cement mortar 1:3 (1 cement: 3 fine sand), deduction for not plastering with cement mortar 1:3 shall be made if the same stand included in the rate for the item of R.C.C. work and the surface finishing as actually done shall be paid for separately.

(c) The exposed surface which is to receive plaster or where it is to be joined with brick masonry wall, shall be properly roughened immediately after the removal of form work, taking care to remove the laitance completely without disturbing the concrete. The roughening shall be done by hacking, wire-brushing etc. as necessary. Before the surface is plastered it shall be cleaned and wetted so as to give to give good bond between concrete and plaster.

The R.C.C. work shall be done carefully so that the average thickness of plaster required for finishing the surface and bringing it shape and form is not more than 6 mm.

(d) The surface of R.C.C. slab on which the cement concrete or mosaic floor is to be laid shall be roughened with brushes while the concrete is green. This shall be done carefully without disturbing the concrete. Before laying the floor, the laitance shall be removed, the surface of slab hacked and a coat of cement slurry at 2.75 kg of cement per square metre shall be applied, so as to get a good bond between R.C.C. and concrete floor. The cost of applying cement slurry shall be paid for separately.

8.2.6.8 Curing
Curing shall be as per Clause No. 8.1.19 above.

8.2.6.9 Basis and Standard of Acceptance
This shall be as per Clause No. 8.1.20 above.

8.2.6.10 Bonding New and Old Work
When the work has to be resumed on a surface which has hardened, such surface shall be roughened. It shall then be swept clean, thoroughly wetted, and covered with a 13 mm layer of mortar composed of cement and sand in the same ratio as the cement and sand in the concrete mix. This 13 mm layer of mortar shall be freshly mixed and played immediately before the placing of the concrete.
Where the concrete has not fully hardened, all laitance shall be removed by scrubbing the wet surface with wire or bristle brushes, care being taken to avoid dislodgement of particulars of coarse aggregate. The surface shall be thoroughly wetted and all free water removed. The surface shall then be coated with neat cement grout. The first layer of concrete to be placed on this surface shall not exceed 15 cm in thickness, and shall be well rammed against old work, particular attention being paid to corners and close spots.

8.2.6.11 Maintenance

Ordinarily maintenance will not be needed for dense concrete constructed in accordance with these specifications. Where however, the concrete is exposed to attack by weather or chemical action, maintenance may be needed. Protective coatings i.e. cement-based paints etc. will delay or prevent deterioration of the concrete in such cases. The protective coatings to be used will depend upon the particular form of exposure, but it should be durable and able to adjust itself to elastic and thermal movements of the structure. All protective coatings should be maintained in good condition by renewed application during the life of the structure.

Painting of concrete structures shall conform to specification given in section 14.3 below. After every three years a periodical check should be made to detect any excessive cracking or other defect or the concrete.

Where corrosion of the bars has caused staining or has loosened the concrete cover, the life of the structure can be considerably prolonged by exposing, cleaning and recovering the bars. Such structures should however be tested occasionally for safety by carrying out load tests. The reinforcement should also be checked frequently to find out corrosion and loosening of the concrete cover.

8.2.7 Measurements

8.2.7.1 Measurements shall be done in cubic metre. The measurements for the following items shall be done separately:

i) Foundations, footings, bases of columns and the like and mass concrete.

ii) Walls (any thickness but not less than 0.10 m thickness) including attached pilasters, buttresses, plinth and string courses etc., from top of foundation up to floor two level.

iii) Suspended floor, roofs, landings, shelves and their supports balconies, girders, bressumers and cantilevers up to floor two level.

iv) Columns, pillars, posts and struts, up to floor two level.

v) Stair cases (except spiral stair cases) excluding landing but including preparing of top surface and finishing of nosing up to floor two level.

vi) Spiral stair cases including landing etc. up to floor two level.
vii) Arches up to floor two level.
viii) Chimney and shaft up to floor two level.
ix) Wall steining.
x) Vertical and horizontal (thickness not more than 0.10 m) individually or forming box louvers and projected band up to floor two level.
xii) Lintels, beams, girders, bressumers and cantilevers up to floor two level.
xi) Chajjas.

xiv) String courses, coping, bed plates, anchor blocks, plain window sills and the like.

xv) Small arched lintels not exceeding 1.5 m clear span over ceilings, copings and the like.

xvi) Moulding as in cornices, window sills etc. exceeding 15 cm in girth.

xvii) Mouldings as in cornices, window sills etc. not exceeding 15 cm in girth.

xviii) Eaves board.

Reinforced concrete shall be measured as per Clause No. 8.1.21 above.

8.2.7.2 No deductions shall be made for the following:

i) Ends of dis-similar materials (e.g. joists, beams, posts, girders, rafters, purisms trusses, corbels, steps etc.) up to 500 sq.cm. in section.

ii) Opening up to 0.1 sqm.

Note: In calculating area of openings the size of opening includes the thickness of any separate lintels or sills. No extra labour or forming such opening or voids shall be measured.

iii) The volume occupied by reinforcement shall not be deducted; and

iv) The volume occupied by drainage, water pipes, conduits, etc. not exceeding 100 sqm each in cross-sectional area shall not be deducted.

8.2.7.3 Nothing extra shall be paid for leaving and finishing such cavities and holes.

All plain, rebated, grooved, locking and tongued joints shall be deemed to be included in the process of process of laying.

8.2.7.4 Walls, suspended floors, landings and projecting proration of chajjas of average thickness less than 15 cm. shall be grouped separately.

8.2.7.5 The slab shall be taken as running continuously through and the beam as the portion below the slab except in case of inverted beam in which case the measurements shall be taken as per Clause 8.2.7.6 below.

8.2.7.6 In floor one column shall be measured from the top of footings or pedestals to the floor two level of the floor level. In the case of columns for flat slabs the flare of the columns shall be included with the column for measurement.

Beams shall be measured from face to face of the columns and shall include haunches, if any, between the columns and beams. The depth of the beams shall be
measured from the bottom of the slab the bottom of the beam except in case of inverted beam, where it shall be measured from top of slab to top beam. The cross-section of the beam shall be the actual cross-section below or above the slab. Shaded portions in sketches below illustrate measurement of cross-section of beams for a few typical cases.

8.2.7.7 Walls and retaining walls shall be measured from the top of footings.

8.2.7.8 Chajja along with its beaming wall shall be measured in cubic metre nearest to two places of decimal. When chajja is combined with beam or lintel, the common portion shall be measured as chajja when chajja or balcony is in continuation of roof of suspended floor, it shall be measured upto the central line of bearing.

Whenever vertical fins and chajjas are combined, the chajjas shall be measured clear between the fins. The vertical fins shall be measured through.

8.2.7.9 The thickness of R.C.C. work shall measure correct to a 0.5 cm. Other dimensions of R.C.C. work shall be measured correct to a cm.

For measurements of R.C.C. under water, reference may be made to Clause No. 8.1.21 above.

8.2.8 Rate

The rate includes all operations as described above, but excludes the cost of formwork and reinforcement, including bending, binding and placing in position unless otherwise specified. The rate includes the cost of materials and labour including water charges to be carried out for different operations. It also includes the contractor's profit and overhead charges @ 10% and 5% respectively.

Separate rate has been provided for providing mild steel/tor steel reinforcement for R.C.C. work including bending, binding and placing in position complete upto floor level two.

In case water borne aggregates to be used instead of graded/crushed stone aggregates, the rates shall be suitably decreased as mentioned in the applicable DSR Vikas Nagar(Dehradun),Schedule of Rates, for 2012-2013

8.3 Finishing

8.3.1 Rendering

The top of suspended floors, landings and stair cases, (treads and risers) shall be rendered smooth with cement mortar 1:2 (1 cement: 2 sand). The floating coat of neat cement shall also be applied and then the surface should be cured properly. The surface shall be protected with a layer of 7.5 cm earth laid over 15 mm layers of sand in case of suspended floors, landings and steps etc. After the proper curing
has been done, the earth and sand etc. should be removed subsequently and all the surfaces should be cleaned.

The measurement is to be done in square metres and the rate includes all the operations described above.

8.3.2 Application of cement slurry

The surface of R.C.C. slab on which the cement concrete or mosaic floor is to be laid shall be roughened with brushes while the concrete is green. This shall be done carefully without disturbing the concrete. Before laying the floor, the laitance shall be removed, the surface of slab hacked and a coat of cement slurry at 2.75 kg of cement per square metre shall be applied so as to get a good bond between R.C.C. and concrete floor. The cost of applying cement slurry shall be paid for separately.

The rate includes cost of cement, carriage by mechanical transport upto 1 km and by head load upto 100 meters, water charges, contractor's profit @ 10% and overhead charges @ 5%.

8.3.3 Finishing on exposed surfaces

This shall be as per Clause 8.2.6.7 above.

The rate includes cost of materials, labour, water charges, and contractor's profit @ 10% and overhead charges @ 5%.

8.3.4 Plaster drip

Plaster drip or throating and mouldings to R.C.C. chajja shall be provided as per the approved drawings or as per the direction of the Engineer. The rate includes cost of labor, Impregnated fiber board

The impregnated fibre board shall conform to requirement of IS: 1838 and shall be got approved from the Engineer. The joint filler shall consist of large pieces and assembling of small pieces shall be avoided. The rate includes the cost of impregnated fibre board, primer ceiling compound and labour. The rate also includes contractor's profit and overhead charges etc.

8.4 Faulty Concrete Construction

8.4.1 Failures vs. Defects

When one considers the many possibilities for slighting or improperly performing the work of making concrete, actual failures are relatively rare. Concrete may have been either deficient in cement, made with dirty aggregates, drowned with water, or allowed to dry out-but unless two or several of these occur at the same time, failure will not usually result. It is believed that poor work is generally due to lack of chemical knowledge rather than to actual dishonesty.
8.4.2 Defects

Defects, however, occur in most structures which are otherwise well built and which are satisfactorily performing their intended service. Sometimes these defects are so many and so glaring that the structure may become unfit for use, but more often they are conspicuous rather than serious. In any case, it is worthwhile to avoid defects by incorporating sound ingredients into a uniformly dense mixture of concrete and by placing and curing this mixture with reasonable care.

The various operations involved in making concrete are well known to builders. Good results are obtained not so much because of what is done as because of how it is done. Workmanship is the key note to a first-class job, and general carelessness of haste is the sure forerunner of defects. The fact that parts (usually nine-tenths or more) of even a defective structure are sound and hard shows that the same builder could get satisfactory results when the requirements for good concrete were met.

This chapter is not intended either in criticism or commendation of concrete, but to point out that too often small structures are built of needlessly low quality and that consequently they are unsightly and short-lived. It is hoped that builders generally may become dissatisfied with the lax standards of the past twenty yearly and will in the future build concrete of the high quality which can be obtained when desired, as shown by numerous examples.

In addition to the specific causes leading to poor results listed in the following table, it may be said generally that large contributing factors are aiming at too low quality and lack of proper supervision and inspection.
9. STONE WORK – MASONRY AND SOLING

9.1 Materials

9.1.1 Stone

Stone used for stone masonry shall comply with specifications given below.

9.1.1.1 Quarried Stone in Blocks (Undressed)

The stone shall be of the specified variety (such as granite, trap stone, sand stone, quartzite, etc.) The stone shall be obtained only from an approved quarry and shall be hard, sound, durable and free from defects like cavities cracks, sand holes, flaws, injurious veins, patches of loose or soft material, etc. Stone with round surface shall not be more than 5 percent when tested in accordance with IS: 1124-1974 (Method of test for water absorption of natural building stones). The minimum crushing strength of building stone shall be 200 kg/sqm unless higher minimum strength is specified in any particular case. All stone shall be obtained by quarrying large massive rock unless otherwise specified.

9.1.1.2 Ordinary Quarried Stone

This stone shall be of the same specification as per item 9.1.1.1 above. This type of stone shall however be used in masonry or filling voids etc.

9.1.1.3 Through Bond Stones and Quoins

9.1.1.3.1 Bond Stones

The Bond Stones or through stones running right across the thickness of the walls, shall be provided in walls upto 600 mm thick. In thicker walls 2 stones over-lapping each other by at least 150 mm shall be provided across the thickness of the wall to form Bond Stone. There shall be at least 1 bond stone for 0.5 square meter of wall surface. The bond stone marked by the distinguishing latter during construction for subsequent verification and shall be laid staggered in subsequent layers.

In case of highly absorbent type of stones (Porous lime stone and sand stone etc.) the bond stone shall extend about 2/3rd into the walls. Through stones in such cases may give high to dump penetration. Therefore, for all thicknesses of such walls a set of 2 or more bond stone over-lapping each other by atleast 150 mm shall be provided. Where Bond Stones of suitable lengths are not available Cement Concrete Block of 1:3:6 mix (1 cement : 3 coarse sand : 6 graded stone aggregate 20 mm nominal size) shall be used.

Through and Bond Stone shall broadly be staggered separately from ordinary building stone and the stack shall be marked to distinguish it from the rest.
9.1.1.3.2 Quoins

The Quoins or corner stone shall be selected neatly dressed with Hammer and or chisel to form required corner angle and laid header and stretcher alternately. The bed and top surfaces of Quoins shall be chisel dressed to give horizontal point. The quoins shall have uniform chisel draft of atleast 25 mm width at 4 edges of each exposed face of the edges of the same face being in one plane. No quoins stone shall be smaller than 0.025 cubic meter (25 dm) in volume and it shall also not be less than 300 mm in length, 25% of it being not less than 500 mm in length.

9.1.1.4 Stone for Soling/Filling Crates etc.

9.1.1.4.1 Source

Stone for soling/filling crates shall be obtained from the quarries/ sources as specified in the Contract. When the source/quarry is not specified these shall be obtained from the source as, approved by the Engineer, from which the best material nearly used for the purpose in the locality are obtained. The sample of the material shall be kept in the custody of Engineer and all subsequent supplies shall conform strictly to the sample.

9.1.1.4.2 Stone for Soling

9.1.1.4.2.1 General

Stone for soling shall be granite, trap, basalt, lime stone, laterite, Kankar or any other as indicated. Stone shall be clean, hard, free from laminations, unsound fragment and free from decay and weathered stuff.

9.1.1.4.2.2 Collection

The soling stone shall be collected in the requisite quantity to give the specified depth after laying. Material collected, in excess, shall not be paid for and if not removed within 1 month to field measurement, shall become the property of Govt. The collection shall begin in each km from the end farthest from the source of supply and shall proceed continually till the km has been filled.

9.1.1.4.2.3 Size

Soling stone shall not be less than 4 kg in weight or more than the depth of the soling in thickness with only enough small stones to fill interstices after the large stones have been hand packed in laying. Soling stone shall not be more than 23 cm nor less than 10 cm in any direction.

9.1.1.4.2.4 Tests

Different tests shall be as per requirements of Specification for Road and Bridge Work (MORT&H) published by Indian Road Congress (IRC).
9.1.1.4.2.5 Royalty etc.
Unless otherwise specified all charges for royalty, forest and other taxes, octroi etc. shall be paid by the Contractor and are included in the rates.

9.1.1.4.3 Stone for Filling Crates

9.1.1.4.3.1 General
The Stone used in Apron shall be sound and durable and fairly regular in shape. Stone subject to marked deterioration by water or weather shall not be used.
The size of stone shall be as large as possible. In no case any fragment shall be less than 40 kg. The specific gravity of stones shall be as high as possible and it shall not be less than 2.50.

9.1.1.4.3.2 Royalty etc.
Unless otherwise specified all charges for royalty, forest and other taxes, octroi etc. shall be paid by the Contractor and are included in the rates.

9.1.1.5 Stone for Pitching

9.1.1.5.1 General
Stone subject to marked deterioration by water or weather will not be accepted. The stone shall be sound, hard, durable and fairly regular in shape. The best stone procurable shall be supplied and in no case shall any fragment weigh less than 40 kg unless otherwise permitted by the Engineer. The size of spalls shall be minimum 25 mm and shall be suitable to fill the voids in the pitching.

9.1.1.5.2 Royalty
Unless otherwise specified all charges for royalty, forest and other taxes, octroi etc. shall be paid by the Contractor and are included in the rates.

9.1.2 Mortar
Mortar used shall comply with specifications as given in section 8.2.2.5 above.

9.1.3 Concrete
Concrete used shall comply with specifications as given in section 8 above.

9.1.4 Sand
Sand shall comply with specification given in section 8.1.2.2.2 above.

9.1.5 Water
Water for stone masonry shall comply with specification given in section 8.1.2.3 above.

9.2 Stone Masonry
9.2.1 General specifications

9.2.1.1 Dressing
Dressing of stones shall be as specified for an individual type of masonry work and it shall conform to the general requirement for dressing of stones covered in this chapter. Other specific requirements are covered separately with respect to particular type of stone work.

9.2.1.2 Bond stone
Through and bond stones shall broadly be stacked separately from ordinary building stones and the stack shall be marked to distinguish it from the rest. Marks must be made on each bond.

9.2.1.3 Wetting of stones
All stones for masonry in cement or lime mortar must be thoroughly wetted before being laid to prevent absorption of water from mortar and the masonry work must be kept wet while in progress. Care being taken to avoid washing mortar out of the joints.

9.2.1.4 Preparation of bed
Stones shall be laid on their natural quarry beds so that the pressure borne by them is normal to the beds. The courses shall be perpendicular to the pressure to be borne and in case of batter walls, beds of stones and the plane of courses should be at right angles to the batter.

9.2.1.5 Laying of stones
Wherever practicable, the whole masonry in any structure must be carried up at a uniform level throughout. Where breaks are unavoidable, the joints shall be made in gradual steps. Cross walls must be carefully bonded into main wall and all junctions of walls to be formed at the time the walls are being built.

9.2.1.6 Work to proceed uniformly
Wherever practicable, the whole masonry in any structure must be carried up at a uniform level throughout. Where breaks are unavoidable, the joints shall be made in gradual steps. Cross walls must be carefully bonded into main wall and all junctions of walls to be formed at the time the walls are being built.

9.2.1.7 Bonds and Joints
Joints parallel to the external pressure must be staggered and should not be continuous. In other words, the stone in any course shall overlap the joint in the course below. In order to obtain sufficient transverse bond, the prescribed number of
headers must extend through the entire thickness of these walls or from outside face to a prescribed depth within thick walls. Such headers are termed as through or bond stones. The practice of building two thin faces of stone masonry tied with occasional through stones and filling up the space between the masonry faces with fine, small or dry stone backing shall not be permitted. To obtain proper bond at angle junction of walls, the stone at each alternate shall be carried into each of the respective walls.

All stones shall be laid full in mortar both in bed and in vertical joints and settled carefully in place with a wooden mallet immediately on placement so that it is solidly bedded in mortar before the same has set. Clean chips and spalls shall be wedged into the mortar joints and beds wherever necessary, to avoid thick beds or joints of mortar. Whenever foundation masonry is laid directly on rock, the face stones of the first course shall be dressed to fit into the rock snugly when pressed down in the mortar bedding over the rock. No dry or hollow space shall be left anywhere in the masonry and each stone shall have all the embedded faces completely covered with mortar.

Courses of the masonry shall ordinarily be pre-determined. They shall generally be of the same height. Where there is variation in the height of courses, larger courses shall be placed at lower levels, with height of courses decreasing gradually towards the top, unless otherwise specifically mentioned in the contract.

All necessary chases for joggles, dowels and cramps shall be formed in the stone beforehand. Bell shaped bond stones or headers shall not be used. In case of thick walls, bond stones shall overlap each other in their arrangement.

All connected masonry in structure shall be carried up at one uniform level throughout as far as possible, but when breaks, are unavoidable, the masonry shall be raked in sufficient long steps to facilitate jointing of new work with old. The stepping of raking shall not more than 450 with the horizontal. Wing walls, abutments and piers etc., shall be carried up truly plumb or to the specified batter.

Face work and hearting shall be brought up evenly. The top of each course, however, shall not be levelled up by use of flat chips.

9.2.1.8 Quoins

Quoins shall be laid as header and stretcher in alternate courses. Quoins and jambs shall be dressed at a right angle to the bed, the corners being straight and vertical. In the case of masonry with hammer dressed stones, a chisel draft 2.5 cm wide shall be given on each external face to allow of accurate plumbing. If for architectural
Section 6 - Works Requirements

reasons, chisel draft is not to be allowed, the corner shall be dressed to a vertical line as best as possible. The cost of quoins and jambs is included in the rate for masonry.

9.2.1.9 Plumb bob and straight edges
In case of vertical walls, all masonry shall be taken up truly plumb and each set of four masons shall be provided with a plumb bob and straight edges. In case of default the Assistant Engineer will supply these, deducting the cost from the Contractor.

9.2.1.10 Lintels and inside stones
All lintels and inside stones not to be plastered over shall be of the full thickness of the wall in which they are laid, including the plastered face or faces with a grooved joint at the junction of the plaster and stone.

9.2.1.11 Rounded corners
Interior and exterior-corners of walls and projecting angles shall be rounded if specified. The drawings shall also indicate the shapes and radii of rounded corners. Rounding of corners is payable separately in case of exposed masonry, but not in case of masonry to be plastered.

9.2.1.12 Cleaning work and striking joints
Mortar shall be confined to the joints and none should be smeared over faces of stones that are not to be plastered. If some mortar does fall on the stones during construction, it should be removed immediately and not allowed to set. Where pointing is not provided to be carried out afterwards, the joints in each day's work shall be struck by a separate mason following up the masonry work. This shall be paid for separately by superficial measurements as striking joints.

9.2.1.13 Fixtures
All iron, stone, concrete or other fixtures, returns, buttresses etc. shall be built and bonded into the masonry in the correct position as work proceeds and not instead or joggled on afterwards. Fixtures shall be built into the masonry in 1:3 cement sand mortar. The work of building these fixtures in the masonry is included in the rate of masonry irrespective of the sources of supply of these fixtures.

9.2.1.14 Bed plates
Bed plates shall be provided under the end of beams, girders, roof trusses etc. Bed plates shall be either chisel dressed on top and bed, or of cement concrete, if so specified, and shall conform to the dimensions given in the drawings. Bed plates
shall be carefully laid with fine joints with the necessary packing to give the correct level.

9.2.1.15 Dowels and cramps

Dowels, cramps and joggles shall be supplied and used wherever specified or ordered by the Executive Engineer. Cramps shall be of gun metal and shall be in length of 16.5 cms and 30 cms, in thickness 6 mm, 15 mm and 25 mm in width as specified and having each end turned at right angle. Iron cramps shall not be used. Cramps shall be forged and set with neat cement. Dowels and joggles shall be of double wedged made from similar stone, and set in neat cement. Iron dowels or joggles whether galvanised or otherwise shall not be used.

9.2.1.16 Scaffolding

Proper scaffolding with tightly fastened joints having two sets of vertical supports (of which the wall may be one) shall be provided. The scaffolding should be strong enough to bear construction loads, and if the Engineer does not consider it strong enough, he can call upon the Contractor to strengthen it, but nothing in this case shall be deemed to mean that he is responsible for the safety of either the work or scaffolding or of the workmen using the scaffolding. This responsibility shall entirely be that of the Contractor. Where stone wall has to remain exposed on both faces, double scaffolding shall be provided.

9.2.1.17 Weather protection and watering

Stone masonry laid in cement or lime mortar shall be protected during construction from the effects of rain and frost by suitable over, if necessary. It shall be kept moist for a period of 10 days. The work shall be left flooded at the end of each day with 25 mm of water. Stone masonry laid in mud mortar shall not be watered but shall be protected during construction from rain or from uneven drying.

9.2.2 Stone Work – Individual Items

Particular specifications for individual items given below are in addition to the general specifications for stone work given above which shall apply to the individual items so far as they are applicable or unless otherwise specified.

9.2.2.1 Dry Random Rubble Masonry (Uncoursed/Brought to Course)

9.2.2.1.1 General

Dry rubble masonry or dry stone walling shall be used in constructing breast and retaining walls, revetments walls and parapets.

9.2.2.1.2 Stones
Stones shall comply with specifications as given in section 9.1.1 above. The stone shall not be less than 15 cms in any direction except the packing stone. The face stone's average breadth shall not be less than the height and average length not less than 1-1/2 times the height for stones upto 20 cm height and not less than 1-1/3rd the height or 30 cm, whichever is more, for stones exceeding 20 cms in height.

The bond stones shall run right across the wall and shall not be less than 300 sq.cm. in cross section at any point. In masonry wall thicker than 60 cm two bond stones overlapping each other by at least 150 mm may be used in conjunction. The bond stones shall be provided @ 2 per square metre of front face area.

The bond or through stones shall be of the full height of the course in which they are used and shall be as broad as possible and of greatest length procurable. All bond or through stones shall be separately stacked before use and the face marked suitably so that they can be identified after having been built into the wall.

9.2.2.1.3 Laying

The stones in the foundations shall be the longest available, shall be laid close to each other and packed in by hand. The front and back stones shall be laid alternately as headers and stretches as far as possible. The stones in the hearting shall be laid interlocking each other. The stones shall break joints with the stones below. The bond stones shall be laid in a line from front face to back overlapping each other by at least 150 mm. The courses shall be built in perpendicular to this pressure which the masonry will bear. In case of battered (such as retaining walls) the beds of stones and the plans on of course shall be laid with their bed at right angles to the battered face.

9.2.2.1.4 Batter

Dry stone walling should not have face batter steeper than 1:12 and until otherwise specified, batter shall be 1:4. The back of the wall shall be vertical; foundations as well as the courses must run at right angles to the face batter and not horizontally.

9.2.2.1.5 High walls

Dry stone wall higher than 6 metres should be strengthened by laying three consecutive courses of squared rubble masonry coursed in lime or cement mortar at every 3 metres interval.

9.2.2.1.6 Long walls

Where ordered by Executive Engineer, long lengths of dry rubble walls should lie divided into panels separated from one another by short lengths of walls metres long built with squared rubble courses in lime or cement mortar at intervals of say 6 to 9
metres in order to confine damage, if any, only to the panels affected and thereby to minimise the repairs required.

9.2.2.1.7 Weep holes
Weep holes shall be provided in dry stone walling when built against earth or hill slopes subject to saturation by surface or ground water flow. Weep holes shall be backed by coarse gravel and important walls by graded filters composed of coarse sand and gravel. The weep holes shall be as per specification given in the retaining walls.

9.2.2.1.8 Filling
Filling immediately behind dry stone wall must, wherever possible consist of stone refuse or chips or coarse gravel. Clayey and silky soil should not be used, where stone refuse or gravel is available.

9.2.2.2 Dry Polygonal Random Rubble Masonry

9.2.2.2.1 General
In this type of random rubble masonry the face stones are of very irregular shape most of them forming polygons. The stones are used as they come out of the quarry and if sufficient stones with polygonal faces are not forthcoming some of the stones are hammer-dressed to give polygonal faces.

9.2.2.2.2 Laying
Stones are laid to a random arrangement, care being taken to lay them as close to each other as possible.

9.2.2.2.3 Other respects
In all other respects, the work will conform to specification 9.2.2.1 above for random rubble masonry.

9.2.2.2.4 Two types of works
Polygonal random rubble masonry of this type can either be un coursed (as shown in Fig. 7 (a) or it can be brought up to course by levelling after every 45 to 60 cm vertical interval Uncoursed Rubble Masonry/Random Rubble Polygonal Faced Masonry

9.2.2.2.5 Materials

9.2.2.2.5.1 Stone
Stone shall comply with specifications given in section 9.2.2.1.2 above.

9.2.2.2.5.2 Mortar
The mortar used shall be cement mortar / lime mortar / lime pozzolana mortar / cement lime mortar / lime surkhi mortar of specified proportion or mud mortar. The detailed specification for mortar given under section 8.2.2.5 above shall apply.

9.2.2.2.5 3Dressing of stones

Stone used for uncoursed or random rubble masonry work shall be hammer dressed on the sides and beds in such a way as to close up with the adjacent stone in the masonry work as strongly as possible. The face stones shall be dressed in such a manner as to give to specified pattern such as polygonal facing etc. The face of stones shall be so dressed that bushing on the exposed face shall not project by more than 40 mm from the general wall surface and on the face to be plastered it shall not project by more than 10 mm nor shall it have depressions more than 10 mm from the average wall surface.

9.2.2.6  Laying

9.2.2.6.1 All stones shall be sufficiently wetted before laying to prevent absorption of water from mortar. The wall shall be built truly plumb (or true to required batter when so specified). All connected walls in a structure shall normally be raised up uniformly and regularly. However if for any specific reason, one part of the masonry is required to be left behind, the wall shall be raked back at an angle not steeper than 45°. Toothed joints in masonry shall not be allowed.

The work shall be carried up regularly and masonry on any day will not be raised by more than 1 metre in height.

Stones shall be laid in an uncoursed fashion, or to produce specified pattern such as polygonal facing, random facing etc. However the masonry is required to be brought to level at various stages viz. plinth level, window sill level, lintel level, roof level and any other level specifically shown in the drawing. This may be done by firstly adjusting the laying of stones to one level and then by providing a leveling course of cement concrete 1:6:12 (1 cement : 6 sand : 12 graded stone aggregate of 20mm nominal size) or as otherwise specified in the Contract.

9.2.2.6.2 Proper bonding shall be achieved by closely filling in adjacent stones as well as by using bond stones as described herein below. Face stones shall extend back sufficiently and bond well with the masonry. The stones shall be carefully set so as to break joints and avoid formation of vertical joints. The depth of stone from the face of the wall inwards shall not be less than the height or the breadth at the face. The hearting or interior filling of the wall shall consist of rubble stones which may be of any shape. Neither the face stone nor the hearting stone shall be so small as to
pass through a circular ring of 150 mm internal diameter in any direction, nor shall any of them have such minimum thickness so as to make it possible to pass it through a rectangular slit of 100 mm width, in any direction.

9.2.2.6.3 All stones shall be carefully laid, hammered down by a wooden mallet into position and solidly embedded in mortar, chips and spalls of stone may be used wherever necessary to avoid thick mortar beds or joints, at the same time ensuring that no hollow space is left anywhere in the masonry. The chips used shall not be more than 20% by volume of masonry, and in the case of random rubble masonry or polygonal faced masonry no spalls or chips shall be seen on the exposed face. The hearting shall be laid nearly level with the face stones except that at about one metre intervals, vertical bond stones or plumbs projecting about 150 to 200 mm shall be firmly embedded to form vertical bonding in masonry.

9.2.2.6.4 Bond stones

Bond stones or through stones running right across the thickness of the wall shall be provided in walls up to 600 mm thick. In thicker walls two stones overlapping each other by at least 150 mm shall be provided across the thickness of the wall to form bond stones. There shall be at least one bond stone for every 0.5 sqm of wall surfaced. The bond stone shall be marked by a distinguishing letter during construction for subsequent verification and shall be laid staggered in subsequent layers.

9.2.2.6.5 Quoins

The quoins or corner stones shall be selected stones neatly dressed with hammer and/or chisel to form the required corner angle laid header and stretcher alternately. The bed and top surface of quoins shall be chisel dressed to give horizontal joints. The quoins shall have a uniform chisel draft of at least 25 mm width at four edges of each exposed face, all the edges of the same face being in one plane. No quoin stone shall be smaller than 0.025 cum. (25dm³ in volume) and it shall also not be less than 300 mm in length; 25% of them being not less than 500 mm in length.

9.2.2.6.6 Jamb stones

The jambs shall be made with stones specified for quoins except that the stones provided on the jambs shall have their length equal to the thickness of the wall for walls up to 600 mm and a line of headers shall be provided for walls thicker than 600 mm as specified for bond.

9.2.2.6.7 Joints
All joints shall be completely filled with mortar and their width shall not exceed 25 mm. When plastering or pointing is not required to be done, the joints shall be struck flush and finished simultaneously while laying the stones. Otherwise the joints shall be raked to a minimum depth of 20 mm by a raking tool during the progress of laying while the mortar is still green.

This type of masonry is illustrated in Fig. 8.

9.2.2.7 Scaffolding
Single or double scaffolding shall be used. The scaffolding shall be strong and sound. The holes left in masonry for supporting scaffolding shall be filled and made good before plastering.

9.2.2.8 Curing and protection
Green work shall be protected from rains by suitably covering the same. Masonry in cement mortar or composite mortar shall be kept constantly moist on all the faces for a period of at least seven days. The top of masonry shall be flooded at the close of the day. In case of fat lime mortar (with or without Pozzolana) curing shall commence two days after laying of masonry and shall continue for seven days.

9.2.2.3 Coursed Rubble Masonry First Sort/Coursed Rubble Masonry Second Sort
9.2.2.3.1 Materials
Same as for uncoursed rubble masonry/random rubble polygonal faced masonry.

9.2.2.3.2 Dressing of stones
9.2.2.3.2.1 For first sort coursed rubble masonry, face stones shall be hammer dressed so as to give approximately rectangular blocks. They shall be squared on bed and side joints. The bed joints shall be rough chisel dressed for a depth at least 50 mm back from the face, and the side joints shall be so dressed a depth of at least 40 mm back from the face, such that no portion of the dressed surface is more than 6 mm from a straight edge held against the surface. The remaining portions of the respective surfaces shall not project above the chisel dressed bed and side joints. The bushing on the face shall not project by more than 40 mm on an exposed face and 10 mm on a face to be plastered. The hammer dressed stone shall also have a rough tooling for a minimum width of 25 mm along the four edges of the face of the stone.

9.2.2.3.2.2 For second sort coursed rubble masonry the stones shall be dressed as for first sort masonry described above except that no portion of dressed surface shall show a depression of more than 10 mm (as against 6 mm for first sort) from the straight edge placed against the dressed surface.
9.2.2.3.3 Laying

9.2.2.3.3.1 Coursed rubble masonry first sort

All stones shall be wetted before laying the wall shall be built up truly plumb (or to required batter where so specified). All connected masonry in structure shall normally be raised up uniformly and regularly. However, if for any specific reasons one part of wall is required to be left behind such wall shall be raked back at an angle not steeper than 45°, toothed joints in masonry shall not be allowed. The work shall be carried up regularly and masonry on any day will not be raised by more than 1 metre in height.

All courses shall be laid truly horizontal. The height of course shall not be less than 150 mm nor shall more than 300 mm. Face stones be laid in alternate header and stretcher fashion. They shall be so arranged as to break joints by at least 75 mm. Stones shall be laid with grains horizontal so that the load is transmitted along the direction of their maximum crushing strength. The depth of stone from the face of the fall inwards shall not be less than the height or breadth. The breadth of a face stone shall also be not less than 150 mm. Each face stone shall be of the same height in any given course. The courses shall be built in perpendicular to the pressure which the masonry will bear. In case of a battered wall (such as retaining walls) the beds of stone and the plane of courses shall be laid with their bed perpendicular to the battered face.

The hearting or the interior filling of the wall shall consist of flat bedded stones carefully laid on their proper beds in mortar, chips, spalls of stones being used where necessary to avoid excessive use of mortar, care being taken to see that no hollow space is left anywhere in the masonry. Chips shall not be used below the hearting stone to bring these upto the level of the face stones. The use of chips shall be restricted to the filling of interstices between the hearting stones but the volume of chips shall be limited to 10% of the total volume of masonry.

9.2.2.3.3.2 Coursed rubble masonry second sort

This type of masonry shall be constructed in the same manner as first sort masonry described above, except that, the use of chips for filling of interstices shall be limited to 15% of the total volume of masonry and that it is permissible to have courses of varying heights. A course may be made up of single stones or two stones.

9.2.2.3.4 Bond stones
Bond stones shall be provided in the same manner as in the case of uncoursed rubble masonry except that in this case there shall be at least one bond stone for every 1.8 m length of every course.

9.2.2.3.5 Quoins

The quoins, which shall be of the same height as the course to which it belongs shall be formed from selected stone of at least 400 mm length. They shall be laid square on beds as stretchers and headers alternately. The beds shall be rough chisel dressed to a depth of at least 100 mm. These stones shall have a minimum uniform chisel draft of 25 mm width at four edges, all the edges being in the same plane. Quoin stone shall not be smaller than 0.025 cum in volume and it shall also be not less than 300 mm in length, 25% of them being not less than 500 mm in length.

9.2.2.3.6 Joints

All bed joints shall be horizontal and all side joints shall be vertical. Face joints shall not be more than 10 mm thick. All joints shall be properly and completely filled with mortar. On faces where neither plastering nor pointing is required to be done, the joints shall be struck flush and finished simultaneously while laying the stones. In other cases the joints shall be raked to a minimum depth of 20 mm by a raking tool during the progress of work while the mortar is still green.

9.2.2.3.7 Other details

The specification for curing, protection and scaffolding shall be the same as for uncoursed rubble/random rubble masonry described above.

9.2.2.4 Squared Rubble Masonry Coursed)

9.2.2.4.1 Height of courses

The stones shall be laid in horizontal courses not less than 15 cm in height. All the stones in each course shall be of equal height and all courses of the same height unless otherwise specified in which case no course shall be thicker than any course beneath it. All stones to be set full in metal in all bed or vertical joints.

9.2.2.4.2 Dressing

The face stone shall be squared on all joints and beds by hammer dressing with the help of a mason or Waller’s hammer. The face of the stone to be hammer-dressed, and 'bushing' not to project neither more than 40 mm. on an exposed face, nor more than 10 mm on a face that is to be plastered. The beds of stones shall be rough dressed (one line dressed) or hammer dressed true and square for at least 50 mm back from the face, and the joints for atleast 40 mm from the face.

9.2.2.4.3 Joints
All stones shall be set full in mortar along all beds and vertical joints. All beds shall be horizontal and joints vertical. No planings will be allowed on the face. The bees and joints shall not be more than 10 mm in thickness. Along all course, stones shall break joint by at least half the height of the course.

9.2.2.4.4 Size of stones

No face stone shall be less in breadth than its height, nor shall it tail into the work to a length less than its height. At least one third of the stones shall tail into work at least twice their height, or in walls thicker than 60 cm, three times their height. No stone should tail into a point.

9.2.2.4.5 Through stones

Through stones shall be inserted one metre apart in every course and shall run right through walls not more than 60 cm thick. Where the thickness of wall is more than 60 cm a line of two or more headers or stones shall be laid from face to back, which shall overlap each other by at least 15 cm. Care should be taken not to place the through stones of successive courses over each other.

9.2.2.4.6 Quoins

The quoins which shall be of the same height as the course in which they occur shall be formed of header stones at least 45 cm long, laid lengthwise alternatively along each face. The quoins shall be selected stones more carefully dressed, squared and bedded to a depth of at least 10 cm and laid square on their beds.

9.2.2.4.7 Internal face

The work on the internal face shall be precisely the same as on the exterior face, unless the work is to be plastered in which case, the side joints need not be vertical.

9.2.2.4.8 The interior of the wall shall consist of flat bedded stones carefully laid on their proper beds and solidly bedded in mortar, chips and spalls of stones being wedged in wherever necessary, so as to avoid thick beds or joints of mortar, care being taken that no dry work or hollow spaces shall be left anywhere in the masonry. The external and internal face work shall be brought up evenly, but the hearting should not be leveled up at each course by the use of chips.

9.2.2.4.9 Other respects

In all respects the work must comply with the general specification given in 9.2.1 above for stone masonry.

9.2.2.5 Plain Ashlar Masonry
9.2.2.5.1 The stones shall be of the specified type. It shall be hard, sound, durable and tough free from cracks, decay, weathering, and undesirable particles. The stones shall be in accordance with specifications given in section 9.1.1 above.

9.2.2.5.2 Dressing stones

9.2.2.5.2.1 The stones shall be cut to regular and required size and shape so as to have all faces rectangular, and give perfectly horizontal and vertical joints when laid in the walls. The beds, joints and faces shall be chisel dressed in such manner that all waviness and unevenness is completely removed and a fairly smooth surface is obtained. The face which is to remain exposed in final work, as well as the adjoining faces to a depth of 12 mm, shall be so dressed that no point on the dressed face shall vary by more than 1 mm from 600 mm long straight edge. The top and bottom faces that are to form horizontal joints and the sides which are to form vertical joints shall not show a variation of more than 3 mm when tested with a 600 mm long straight edge. Any vertical face that is to come against backing of masonry shall be so dressed that it shall not show variation of more than 10 mm from a straight edge. All angles and edges that are to remain exposed in the final position shall be true, square and free from chippings.

9.2.2.5.2.2 A sample of dressed stone shall be prepared for approval and shall be kept on the work after approval from the Engineer.

9.2.2.5.3 Laying

9.2.2.5.3.1 Stones shall be wetted, before placing in position. They shall be floated on mortar and bedded properly and solidly in position with a wooden mallet.

9.2.2.5.3.2 The wall shall be built truly vertical (or true to required batter as specified). Stones may be laid in alternate header-stretcher fashion or in any other manner as directed by the Engineer. The headers shall be arranging in such a fashion as to bring them centrally over the stretchers below and above. Stones shall break joints on the face for at least half the height of the course and the bond shall be carried up regularly and masonry any day will not be raised by more than one metre in height.

9.2.2.5.3.3 The height of course in a masonry work shall be uniform and shall not be less than (150mm) unless otherwise specified. The width of stone shall not be less than height.

9.2.2.5.3.4 All connected masonry shall be raised uniformly and regularly throughout but when a break is inevitable the joint shall be made in good long steps to avoid cracks.

9.2.2.5.3.5 When necessary, jib crane or other mechanical appliances shall be used to hoist heavy pieces of stones and place them in correct position. They shall be handled
carefully to avoid damage to edges and corners (which are more valuable to damage). No damaged stone shall be allowed to be used in work.

9.2.2.5.3.6 A masonry work may be a composite one consisting of ashlar stone facing with backing of either brick work, uncoursed rubble / coursed rubble masonry, etc. In such cases the two portions shall be carefully bonded. The above specification shall apply to face work and the backing shall be governed, by the appropriate specifications applicable to the type of backing used.

This type of masonry is illustrated in Fig. 8.

9.2.2.5.3.7 Bond stones shall be provided at the rate of not less than one per 1.8 m length in each course. They shall be through stones running across the wall upto 600 mm thick. For thicker walls two stones over lapping each other by not less than 150 mm may be used in conjunction as bond stones. In case of composite masonry (vide 9.2.2.6.3.6 above) the bond stone(s) shall run right across the combined thickness of the wall. Bond stone shall be marked by a distinguishing letter during construction for subsequent verification.

9.2.2.5.3.8 Joints

All joints shall be uniform throughout and not more than 5 mm wide. A uniform recess of 15 mm depth from the face shall be made with the help of a steel plate to receive pointing to be done later.

9.2.2.5.4 Pointing

All exposed joints shall be pointed using mortar with admixture of pigment to match the shade of stone as specified. The pointing when finished shall be sunk from stone face by 5 mm or as specified. The depth of mortar in pointing shall not be less than 10 mm.

9.2.2.5.5 Curing and protection

The masonry shall be cured in the same manner as described in para under uncoursed rubble/random rubble/polygonal faced masonry. The work shall be suitably protected from damage during construction.

9.2.2.5.6 Scaffolding

Double scaffolding shall be adopted. Single scaffolding shall not be allowed. The scaffolding shall be built sufficiently strong and sound keeping in view the heavy load of solid stones and other materials likely to be carried by it.

9.2.2.5.7 Classification

The ashlar masonry can be divided into three classes:
(a) Fine Ashlar: In fine ashlar every stone shall be fine dressed (three line dressing) on all beds, joints and faces, full true and out of winding, if the surfaces are plane, or to uniform curves or twists if required by the design. All stones shall be laid in cement mortar and the beds and joints must not exceed 3 mm in thickness.

(b) Ashlar rough tooled (or bastard ashlar): In this type of ashlar masonry, the faces exposed to view shall have a fine dressed chisel draft 25 mm wide all-round the edges, and be rough tooled (one line dressed) between the drafts, and on all beds and joints. The thickness of joints and beds must not exceed 6 mm. The stones will be set in cement mortar which is specified.

(c) Rock Ashlar, Rustic Ashlar or Quarry-faced Ashlar: This type of masonry is similar to Bastard Ashlar, except that the exposed faces of the stone between the drafts shall be left rough as the stone comes from the quarry. No rock face or bushing may project more than 7.5 cm from plane or drafts. If required for architectural reasons, the drafts may be omitted altogether except on quoins. All the beds and sides of stones shall be rough-tooled (one line dressing). The cement mortar shall be as specified. The beds and joints shall not exceed 6 mm in thickness. Where only ashlar masonry is specified, without indications on the drawings or otherwise, the type of ashlar required will be taken as fine ashlar. As regards size of stones, bond, etc., there is no difference in the three types of ashlar masonry.

9.2.2.6 Punched Ashlar Masonry (Fig. 10)

9.2.2.6.1 Stone

Stone shall be as specified for plain ashlar masonry.

9.2.2.6.2 Dressing

As in plain ashlar masonry except that the faces exposed shall have a fine dressed chisel draft 2.5 cm wide all-round the edges and shall be rough tooled between the drafts, such that the dressed surfaces shall not be more than 3 mm from straight edge placed over it.

9.2.2.6.3 Other details

The specifications for mortar laying, fixing, bond stone, joints, pointing, curing, protection, scaffolding etc. shall be as specified for plain ashlar masonry.

9.2.2.7 Stone Work in Copings, Cornices, Jali, Chowkhats, Lintels, Sills and Roofing etc.

9.2.2.7.1 Stone
Stone used for shelves, copings, cornices, string course, stone jali work, chowkhats etc. shall be of the specified variety and shall be hard, sound, durable and of uniform colour and texture.

9.2.2.7.2 Dressing

All exposed plane surfaces and sides shall be chisel dressed such that the dressed surface shall not vary by more than 1 mm at any point from a 600 mm long straight edge placed against it, except in the case of shelves where a variation of 3 mm shall be allowed. All visible angles and edges shall be free from chippings. The surfaces to be buried in masonry shall be rough chisel dressed. Copings, cornices, chowkhats and sills shall be finished to the shape as shown in the drawing. Jali shall be cut as per the pattern shown in the drawings. Thickness of jali shall be as specified, with a tolerance of 2 mm. Fixing of jali shall be done with adjoining work in grooves, rebates etc. as shown in drawings.

The finished thickness of stone shelves shall be as specified with a permissible tolerance of 2 mm.

9.2.2.7.3 Laying and fixing

Laying and fixing of these items shall be done in cement mortar of specified mix, in the manner shown in the drawing or as directed by the Engineer.

9.2.2.7.4 Other details

Pointing, curing, protection, scaffolding etc. shall be done as specified for plain ashlar masonry work.

9.2.2.7.5 Stone chowkhats

Stone chowkhats for doors, windows and clerestorey windows shall have exposed faces including rebates close picked or three line dressed. The vertical members shall be jointed to horizontal members by mason's mortice and tenon joints and shall be embedded minimum 15 cm deep in floor. Four holes shall be provided to every vertical member of door or window and two to vertical member of clerestorey window for fixing bolts. The projection of the horizontal members shall not be less than 15 cm wide. These shall be well built into the wall at ends. Recesses and holes shall be made in the chowkhats for fixing hinges and bolts staples.

9.2.2.7.6 Lintels, sills and roofing

The stone slabs shall be sawn or split in a plane parallel to the natural bed of the stone obtained from the approved quarry. Thickness of the slab shall be as under:
### Table

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Span</th>
<th>Thickness</th>
</tr>
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<tbody>
<tr>
<td>a)</td>
<td>For clear span upto 2 metres.</td>
<td>7.5 to 10 cm.</td>
</tr>
<tr>
<td>b)</td>
<td>For clear span exceeding 2 m and upto 2.5 metres</td>
<td>Exceeding 10 cm and upto 12.5 cm</td>
</tr>
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The slabs up to three meters shall be in one piece. The increase in weight of the stone slab after 24 hours soaking in water shall not be more than 10 percent of the dry weight.

Stone slabs for roofing shall be soaked in water for 2 hours before use. The width of each slab shall not be less than 25 cm nor more than 35 cm. The slabs shall be self-faced on top and bottom. The edges shall be true and square on the underside and two long edges shall be hammer dressed so that the depression from a 600 mm long straight edge held against the surface shall not exceed 20 mm and the width of the joint between the two adjoining slabs shall not exceed 25 mm. The joints shall be filled solidly with mortar for their full depth and neatly finished on the underside.

#### 9.2.2.8 Stone Work Sunk or Moulded, Ashlar Moulded and Carved Columns (Fig. 11)

##### 9.2.2.8.1 Materials

Stone used for the work shall be of the specified variety and shall be hard, sound, durable, tough and free from defects like cracks, decay, weathering and undesirable patches. Mortar as specified shall be used. For details, specifications of mortars under section 8.2.2.5 above shall apply.

##### 9.2.2.8.2 Dressing

Every stone shall be cut to the required size and shape and chisel dressed on all beds and joints so as to be free from waviness and unevenness. It shall give a perfectly vertical and horizontal joint with adjacent stones. The dressed surface shall not show variation of more than 3 mm when a straight edge is placed against the surface. The face shall be gauged, cut, chamfered, grooved, rebated, sunk and/or plain moulded as shown in the working drawing. A full sized layout of moulding shall be prepared and a neat template cut facilitate the dressing and cutting of stone to require precise shape and size. All visible angles shall be true and square. The surface and moulding obtained shall be the finest obtainable by the process of chisel dressing.

##### 9.2.2.8.3 For important carved work in columns a full-sized model of the work shall be prepared in Plaster of Paris for the approval of the Engineer, if so directed.

##### 9.2.2.8.4 Other details
The specification for laying and fixing, joints, pointing, curing, protection and scaffolding shall be the same as that of stone work in plain ashlar masonry.

9.2.2.9 Dressing of Stones

9.2.2.9.1 General

Stone shall be cut and dressed as soon after quarrying as possible. Stone required for masonry shall be dressed as specified or shown on the drawings. Main types of dressing are prescribed in the following paragraphs. Stones shall be dressed accurately to the exact size shown in the drawings or according to specifications of the masonry work. All visible edges shall be free from chippings. For complete detail of dressing of stones, reference may be made to IS: 1129 (Dressing of stones Revised from time to time).

9.2.2.9.2 Scabbed stones

Scabbed stone means quarried stone in which irregular angles have been taken off with the scabbing hammer, usually done at quarry.

9.2.2.9.3 Hammer dressed stone

When the scabbed stone is dressed with mason's hammer or waller's hammer to make the faces square and to remove unnecessary bushing, it is called hammer dressed stones. No picking or chiseling is used in this type of dressing.

9.2.2.9.4 Rough tooled stone

The rough tooled stone is also called one line dressed stone. It is dressed with a chisel, or sparrow picked until no portion of the dressed surface is more than 6 mm from a straight edge placed on it.

9.2.2.9.5 Chisel dressed stone

Chisel dressed stone is also called "two-line dressed" stone. It is dressed with chisel or sparrow picked until no portion of the surface dressed is more than 6mm from a straight edge placed on it.

9.2.2.9.6 Fine dressed stone

This is also called "three-line dressed" stone. By fine dressing or three line dressing is meant, the best surface which can be given to a stone with chisel, and without rubbing. The straight edge laid along the face of the stone so dressed must be in contact with the stone at every point.

9.2.2.9.7 Finely punched stone
This type of stone means stone having face work to an approximately true surface by means of pointed tools or punch giving a dotted appearance usually specified to give architectural effect.

9.2.2.9.8 Cut stone work

Every stone for cut stone work shall be fine-tooled on all faces to exact shape specified in design. Templates made of zinc sheets shall be used to dress to correct shapes.

9.2.2.9.9 Sawing and polishing

Certain building stones like marbles shall be sawn in blocks wherever so specified and certain stones like granite and marble shall be polished with a stone polishing machine, if so specified. Sand blasting may sometimes be prescribed as a finishing process for building stones.

9.2.2.10 Ashlar Masonry with Sand Stone

9.2.2.10.1 Stone lining upto 8 cm shall be treated as veneer work and the lining of greater thickness as plain ashlar masonry. All specifications as given in ashlar masonry shall be applicable to ashlar masonry with sand stone. Stone used shall conform to specification given in section 9.1.1 above.

9.2.2.11 Stone Work in Arches and Domes

9.2.2.11.1 Materials

Stone used for the work shall be of the specified variety and shall be hard, sound, durable, tough and free from defects like cracks, decay, weathering and undesirable patches. Stone used shall conform to specifications given in section 9.1.1 above.

9.2.2.11.2 Dressing

Every stone shall be cut to the required wedge-shape and size and chisel dressed on all beds and joints so as to be free from waviness and unevenness. Each stone shall give a truly radial and straight joint with the adjoining stone, as shown in the drawing. No point on the dressed surface shall be more than 3 mm from a 600 mm long straight edge placed against it. The faces shall be gauged, cut, chamfered, grooved, rebated, sunk and/or moulded to uniform curves or planes as shown in the working drawings. A full sized layout of each unit of stone shall be prepared and a neat template cut to facilitate cutting of the stones to the required precise shape and size. All visible edges and angles shall be true neat and free from chippings. The exposed surface shall be dressed to give a finest possible finish obtainable by the process of chiselling. At the exposed joints a width of 12 mm back from the face
shall be fine tooled so that the straight edge laid along it shall make a contact with a variation of not more than 1 mm.

9.2.2.11.3 Centring and shuttering

Centring, shuttering and false work required for the arch or dome work shall be strong and unyielding. It shall not sag or deform under load. It shall be got approved from the Engineer before putting up stone work.

9.2.2.11.4 Other details

Other details regarding laying, joints, pointing, curing protection and scaffolding shall be the same as for stone work in plain ashlar masonry. Stone work in arches and domes is illustrated in Fig. 12.

9.2.2.12 Stone Work in Wall Lining etc. (Veneer Work)

9.2.2.12.1 Material

Stone shall be of the specified variety (such as red/white sand stone, trap stone etc.) and shall be obtained from approved quarry. It shall be hard, sound, durable and free from defects like cavities cracks, sand holes, flaws, injurious veins, patches of loose or soft material etc. Percentage of water absorption shall not exceed 5 percent when tested in accordance with IS: 1124-1974. The stones shall be cut into slabs of required thickness along the planes parallel to the bed or natural grains of the stone. The stone used shall conform to specifications in section 9.1.1 above. Mortar for fixing shall be as specified.

9.2.2.12.2 Dressing

The face of the stone slabs as well as the sides shall be chisel dressed in such a way that a smooth surface free from waviness and unevenness is obtained. A straight edge 600 mm long, when held against the dressed face or side shall not show a variation of more than 1 mm. The edges and corners shall be true square and free from chippings. The back of the slab shall be so dressed as to give a rough surface which shall however be free from projection and waviness. The thickness of stone slab after dressing shall be of the specified thickness within the tolerance limit of + 2mm.

9.2.2.12.3 Laying and fixing

The stone slabs shall be sufficiently wetted before laying to prevent absorption of water from mortar. They shall then be fixed with mortar in position without use of chips or pinning of any sort. Where so specified the adjoining stones shall be secured to each other by means of copper pins 75 mm long and 6 mm dia. See Fig. 13.
The slabs shall also be secured to the backing masonry work, if so specified, by means of 25 mm x 6 mm gun metal cramps 30 cm long or other size. The fixing arrangement is shown in Fig. 13. Alternatively the stones may be secured to the backing by means of stone dowels 100 mm x 50 mm x 25 mm as shown in Fig. 14. Pins, cramps and dowels shall be got approved before use. They shall be fixed using cement mortar 1:2 (1 cement : 2 coarse sand).

9.2.2.12.4 The face work and backing masonry shall be built up together. However in the case of backing of reinforced cement concrete the face stones shall be secured to the backing after it has set and got cured. The cramps shall be fixed in concrete at the required positions while concreting. The face stones shall be laid in regular courses not less than 20 cm in height and all the courses shall be of the same height unless otherwise specified in the drawing. The size of each stone and pattern of joints shall be as specified in the drawing.

9.2.2.12.5 Joints

All joints shall be full of mortar. Special case shall be taken to see that the joint between centre of the mass being compacted at the time of the depositing proceeds by means of a suitable type the facing stone slabs and the back masonry is properly filled with mortar. The hollowness behind the veneer stone slab or post joining the back masonry can be detected by tapping the face stone and any such defective work shall be rectified by relaying the stone slabs. The thickness of the face joints shall not exceed 5 mm. The face joints shall be uniform throughout. A 15 mm deep recess shall be formed with the help of a steel plate while the mortar is green.

9.2.2.12.6 Other details

Specification for pointing, curing, protection and scaffolding shall be the same as for stone work in plain ashlar work.

9.2.3 Measurements

9.2.3.1 General

(a) All work shall be measured on the basis of finished dimensions and measured net, except where otherwise specified (herein below).

(b) The lengths, breadths and heights of stone work shall be measured correct to a cm. Only specified dimension shall be allowed. Anything extra shall be ignored.

(c) Work under the following categories shall be measured separately, unless otherwise specified:

a) From foundations to plinth level.

b) Super-structure above plinth level and upto floor two level.
c) Above floor two level of super-structure.
d) Square or rectangular pillars.
e) Circular pillars.
f) Curved on plan for mean radius not exceeding 6 meters.
g) Stone work sunk or moulded in cornices, square, rectangular and circular pillars.
h) Dressing of stone.
i) In or under water and/or liquid mud.
j) In or under foul conditions.
k) Stone work on the parapet shall be measured together with the corresponding item of stone work in the storey next below.

(d) No deduction shall be made, not extra payment made for the following:
i) Ends of joints, beams posts, girders, rafters, purlins, trusses, corbels etc. each upto 500 sq. cm. in section.
ii) Openings each upto 0.1 sqm (10dm²).
iii) Wall plates and bed plates, bearings of chajjas and the like upto 10 cm depth (Note: The bearings of door and roof slabs shall be deducted from masonry).
iv) Drain holes and recesses for cement concrete blocks to embed holdfasts for doors, windows etc.
v) Building in the masonry iron fixtures pipes upto 309 mm dia., holdfasts of doors and windows.
vi) Forming chases in masonry upto Section of 350 sqcm.

(e) Stone masonry in chimney breasts, chimney stacks, smoke flues, or air flues upto 0.25 sqm (25 dm²) in sectional area, shall be measured as solid and no extra payment shall be made for pargeting and casing such flues. Where flues exceed 0.25 sqm in sectional area, deduction shall be made for the flue opening and pargeting and casing of flues shall be paid for separately.

(f) Apertures for fireplaces shall not be deducted and extra labour for splaying of jambs, throating and making arch to support opening shall not be paid for separately.

(g) Plinth level: For purpose of measurements for masonry in plinth and foundation and (or masonry in superstructure, the plinth level shall be determined as under:
i) For Building: Ground floor level or 1.5 metres above ground level whichever is lower.
ii) For abutments, piers and retaining walls of culverts, walls of reservoirs basement and the like 1.5 metres above the ground level shall be as marked in the drawings.

(h) Curved masonry: Stone masonry curved on plan to a mean radius exceeding 6 m shall be measured under stone work in walls of the appropriate category.

9.2.3.2 Individual Items of Work

9.2.3.2.1 Uncoursed rubble masonry / polygonal faced masonry / random rubble masonry (second sort) / pillars (columns) / curved stone work

(a) The finished work shall be measured net in cubic metres nearest to two places of decimal.

(b) Square rectangular pillars shall be measured as walls, under the respective category but extra payment shall be allowed for these over the rate for corresponding stone work in wall. A rectangular pillar shall mean a detached masonry portion rectangular in section such that its breadth does not exceed two and a half times its thickness.

(c) Circular pillars shall be measured net as per actual finished work under the respective category of masonry wall but extra payment shall be allowed for these over the rate for the corresponding stone work in walls.

(d) Curved stone work having a mean radius not exceeding 6 m on plan shall be measured net as per actual finished work under the respective category of masonry wall, but extra payment shall be allowed for this over the rate for the corresponding stone work in walls.

(e) Provisions as given under "General" shall apply.

9.2.3.2.2 Stone work in plain ashlar masonry / ordinary pillars (columns) / moulded and curved columns / curved stone wall

(a) The finished work shall be measured in cubic metre nearest to two places of decimals.

(b) Square, rectangular pillars shall be measured net as per actual finished work and included in the quantity of masonry wall, but extra payment shall be allowed for these over the rate for the corresponding stone work in wall. A rectangular pillar shall mean a detached masonry portion rectangular in section such that its breadth does not exceed three times its thickness and the thickness itself does not exceed 60 cm.

(c) Curved stone work having a mean radius not exceeding 6 m on plan shall be measured net as per actual finished work under the appropriate category of
masonry wall, but extra payment shall be allowed for this over the rate for corresponding stone work in wall.

(d) In case of battered or curved or curved surface (other than curved columns) the dimensions of the circumscribing rectangles of the dressed stone used in the work shall be measured. In such cases the measurement shall be taken, course by course or stone by stone as the case may be.

(e) Provision as given under "General" shall apply.

9.2.3.2.3 Stone work sunk or moulded

(a) The finished work shall be measured in cubic metres nearest to two places of decimals. The dimensions of the circumscribing rectangles of the dressed stone used in the work shall be measured correct to a cm. Measurement shall be taken course by course or stone by stone as the case may be. Only specified dimensions shall be allowed, anything extra being ignored.

9.2.3.2.4 Stone work in arches and domes

The finished work shall be measured net in cubic metres nearest to two places of decimals. Any recognized Engineering formula shall be used for calculating the volume of the work.

For arches exceeding 6 m in span extra payment for additional cost of labour and hire charges in respect of centring shall be made on the basis of arches, area of the soffit including strutting, wedging, casing, striking and removal.

Only specified dimension shall be allowed, anything done extra being ignored.

9.2.3.2.5 Stone work for wall lining etc. (veneer work)

(a) The finished work shall be measured in square metre nearest to two places of decimals. In case of plain slabs of geometrical shape other than square or rectangular, or plain slabs of irregular shape, the dimension of the circumscribing rectangle of the dressed slabs used in the work shall be measured. The veneering work curved in plan shall be measured as plain work but extra payment shall be allowed for radius not exceeding 6 m on external face. For radius beyond 6 m on plan the work shall be measured as plain work only, even when the face may have to be dressed to curve. Length and breadth shall be measured correct to a cm.

9.2.3.2.6 Stone work in shelves, coping, cornices, jali etc.

(a) The finished stone shelves shall be measured net in square metres nearest to two places of decimals. The length and breadth including the bearings shall be measured correct to a cm.
(b) Stone jali shall be measured in square metres nearest to two places of decimals. The net dimensions of the jali including the portion grooved into the adjusting work shall be measured.

(c) Stone copings shall be measured in cum nearest to two places of decimals. The dimensions of the circumscribing rectangles of the dressed stone used in the work shall be measured correct to a cm.

(d) Plain cornices, string course and plinth courses shall be measured in cum nearest to two places of decimals. Length, breadth and depth of finished stones as used in the work shall be measured including bearing, correct to a cm.

(e) Moulded cornices shall be measured in cubic metre under moulded stone work.

(f) No deduction shall be made from the masonry wall for the bearing of stone shelves.

9.2.4 Rate

The rate for various items shall include the cost of materials and labour required for proper completion of item of works as described in the respective nomenclature in accordance with the schedule and specifications above including temporary erection like scaffolding etc. unless otherwise specified.

The rate includes all such items as mentioned in the general specifications of the stone work. Contractor's profit @ 10% and over-head charges @ 5% has also been included in the rate.

9.3 Stone Soling

9.3.1 General

Soling shall be constructed on the prepared sub-grade in conformity with lines, grades, thickness and cross-section shown on drawings or as indicated by Engineer.

9.3.2 Marking out

The edges of soling shall be marked out by strings and stakes. The lines shall be carefully ranged.

9.3.3 Laying and Packing

The soling stones shall be hand packed carefully to the required chambers of the top surface by laying correct to the templates placed 15 meters apart. These shall be laid resting on their broad bases with their height equal to the thickness of the soling and the largest dimension at right angles to the centre line of the road. Stones shall be laid breaking joints in close contact with each other but not leaning against each other. Large size stones shall be arranged at the edges and the centre of the road.
The joints shall be staggered. All interstices between soling stones shall be wedged in by smaller stones of suitable size well driven in by crow bars and hammers to ensure tight packing and complete filling of interstices. The wedging shall be carried out simultaneously with the placing in position of soling stone and shall not lag behind. After the hand packing has been completed, inequalities in the surface shall be checked by templates and carefully set right.

9.3.4 Consolidation

The soling shall be consolidated by a road roller of 8 to 12 tonne as directed by Engineer, depending upon the type of soling stones and the nature of the sub-grade. Rolling shall progress from edges towards the centre, parallel to the centre line. Rolling shall be continued till a closely knit surface is obtained. The surface shall be again checked by templates, hollows corrected with spalls, and consolidated.

10. BRICK WORK

10.1 General Specifications for First Class Brick Work

10.1.1 Materials

10.1.1.1 Bricks & tiles

Unless otherwise specified, brick work shall consist of 1st class brick laid in specified mortar. The bricks used for brick work and the size of brick and tiles and relevant classification shall be as per specifications given below.

10.1.1.1.1 Sizes of Bricks

Unless otherwise specified bricks required for buildings or architectural works shall measure 19 cm x 9 cm x 9 cm (actual) or 20 cm x 10 cm x 10 cm (nominal) so that every 10 courses when laid with horizontal mortar joints shall measure one metre in height. A tolerance upto 6.5 mm in length, ± 3 mm in width and + 3mm in height shall be permitted. This tolerance for size shall be measured as explained in detail in testing of bricks section (i) below.

TESTING OF BRICKS

The sample of bricks shall be taken, so that they form a fairly good representative of the entire number of bricks, which are required to be tested. A sample of 50 bricks shall be taken from every consignment of 50,000 bricks or part thereof. The samples can be taken from either of the two methods:

a) Sampling bricks in motion: In this method, samples can be taken when the bricks are in motion i.e. while they are being loaded or unloaded, effort being made to
collect the samples at regular intervals so as to get a representative sample of the whole quantity.

b) *Sampling bricks from a stack:* In this method, the bricks are taken out at random from a stack of bricks. The number of bricks required shall be taken from across the top of the stack, the sides accessible and from the interior of the stack by opening trenches from the top.

The samples taken by either of the two methods shall be stored in a dry place until these are required for the tests. Whenever, tests are to be carried out, bricks shall be taken at random from the sample.

**(i) Test of Dimensions of Bricks**

a) *Metric Bricks:* Twenty whole bricks shall be selected at random from the sample selected as described above. All blisters, loose particles of clay and small projections shall be removed. They shall then be arranged upon a level surface in contact with each other and in a straight line. The overall length of the assembled bricks shall be measured with a steel tape or other suitable inextensible measure sufficiently long to measure the whole row one stretch. Measurement by repeated application of a short rule or measure shall not be permitted. If for any reason it is found impracticable to measure 20 bricks in one row, the sample may be divided into two rows of 10 bricks, which shall be measured separately to the nearest millimeters. All these dimensions shall be added together.

The dimensions of bricks when tested in accordance with the above procedure shall be within the following limits:

<table>
<thead>
<tr>
<th></th>
<th>367.0 cm to 393.0 cm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length</td>
<td></td>
</tr>
<tr>
<td>Width &amp; Height</td>
<td>174.0 cm to 186.0 cm</td>
</tr>
</tbody>
</table>

b) *Non-metric Bricks:* The test will be carried out exactly in the same manner as described for metric bricks but only 16 bricks shall be used. Their dimensions when, tested in accordance with above procedure shall be within the following limits:

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Length</td>
<td>140 inches to 148 inches</td>
</tr>
<tr>
<td>Width</td>
<td>68 inches to 72 inches</td>
</tr>
<tr>
<td>Height</td>
<td>47 inches to 51 inches</td>
</tr>
</tbody>
</table>
Every brick shall be provided with a frog of the size 10 cm x 4 cm x 1 cm. The corners of the frog may in certain cases be rounded off with a radius of 2 cm.

The bricks used shall be of the specified class and size. The nominal and actual sizes of different categories of bricks and brick tiles shall be as under:

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Types of Bricks</th>
<th>Nominal Size</th>
<th>Actual Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>i)</td>
<td>Modular bricks</td>
<td>20 cm x 10 cm x 10 cm</td>
<td>19 cm x 9 cm x 9 cm</td>
</tr>
<tr>
<td>ii)</td>
<td>Modular brick tiles</td>
<td>20 cm x 10 cm x 5 cm</td>
<td>19 cm x 9 cm x 4 cm</td>
</tr>
<tr>
<td>iii)</td>
<td>Conventional FPS bricks</td>
<td>9” x 4-1/2” x 3”</td>
<td>9” x 4-3/8” x 2-3/4”</td>
</tr>
<tr>
<td>iv)</td>
<td>Conventional FPS bricks tiles</td>
<td>9” x 4-1/2” x 2”</td>
<td>9” x 4-3/8” x 1-3/4”</td>
</tr>
<tr>
<td>v)</td>
<td>FPS large size bricks</td>
<td>10” x 5” x 3”</td>
<td>10” x 4-7/8” x 3”</td>
</tr>
<tr>
<td>vi)</td>
<td>FPS large size bricks tile</td>
<td>10” x 5” x 2”</td>
<td>10” x 4” x 2”</td>
</tr>
</tbody>
</table>

The permitted tolerance in sizes for bricks of Class ‘I’ is ± 3% and that for bricks of Class ‘II’ is ± 8%.

10.1.1.1.2 Classification

Bricks shall be classified as follows:

10.1.1.2.1 First Class Bricks

The first class bricks shall conform to the following specifications:

(a) The size of bricks shall be as specified subject to the tolerance mentioned in 10.1.1.1.1 above.

(b) They shall be made from good brick earth, free from saline deposits and shall be sand moulded.

(c) They shall be thoroughly burnt without being vitrified and shall have uniform deep red, cherry or copper colour.

(d) They shall be regular and uniform in shape and size with sharp and square arises and parallel faces.

(e) They must be homogenous in texture and emit a clear ringing sound on being struck.

(f) They shall be free from flaws, cracks, chips, stones nodules or lime or Kankar and other blemishes.

(g) A first class brick shall not absorb water more than 20% of its own dry weight after 24 hours immersion in cold water.
Details of this test are given in testing of bricks section (ii) below.

(ii) Test for Determination of Water Absorption of Bricks

a) Laboratory Test: The test specimens shall consist of five whole bricks selected at random from the sample of brick obtained as already described in testing of bricks section above.

**Apparatus:** The apparatus shall consist of a balance sensitive of within 0.1 percent of the weight of the specimen.

**Procedure:** The test specimen shall be dried to constant weight in a ventilated over at 110° C to 115° C. If the specimen is known to be relatively dry, this may normally be accomplished in 48 hours but if the specimen is wet, several additional hours may be required to attain constant weight. The specimen shall then be cooled approximately to room temperature and weighed. In a ventilated room, bricks properly separated require four hours for cooling, unless an electric fan passes air over them continuously, in which case two hours may suffice. Specimens noticeably warm to the touch shall not be used for the absorption test. The dry specimens shall be completely immersed without preliminary partial immersion, in clean water at 15.5° C to 30° C for 24 hours. Each specimen shall then be removed, the surface water wiped off with a damp cloth and the specimen weighed. Weighing anyone specimen shall be completed within three minutes after removing the specimen from the water.

**Evaluation and report of test:** The percentage of water absorption by weight shall be calculated as:

\[
\text{Water absorption, percentage by weight} = \left(\frac{W2 - W1}{W1}\right) \times 100
\]

where,

\( W1 \) = Weight of dry specimen, and

\( W2 \) = Weight after soaking in water.

The average value of the five specimens shall be taken as the water absorption of the lot.

b) Field Test: The test specimen shall consist of five whole dry bricks and shall be selected at random from the simple obtained as already described in testing of bricks section above.

**Apparatus:** The apparatus shall consist of a balance sensitive of within 0.2 to 0.3 percent of the weight of the specimen.

**Procedure:** The test specimen shall be weighed and shall then be completely immersed in clean water at room temperature and allowed to remain in this state
for a period of 24 hours: The specimen shall then be taken out, wiped with a damp cloth and then weighed immediately.

_Evaluation:_ The percentage of water absorption by weights shall be calculated as follows:

Absorption, percent by weight after 24 hour's water immersion = \(100 \times \frac{b-a}{a}\)

where,

\(a\) = Weight of the dry specimen, and

\(b\) = Weight of the specimen after 24 hours immersion in cold water.

(h) The first class bricks shall have a minimum crushing strength of 105 kg per sqcm when tested according to the test prescribed in testing of bricks section (iv) below. The crushing strength of any individual brick shall not fall below the average crushing strength by more than 20 percent.

(i) First class bricks shall not show appreciable signs of efflorescence either in dry state or subsequent to soaking in water as detailed in testing of bricks section (iii) below.

(iii) **Test for Determination of Efflorescence of Bricks**

a) _Laboratory Test:_ Not less than five dry bricks shall be selected at random from the sample of bricks obtained as already described in testing of bricks section above.

_Procedure:_ Each brick shall be placed on end in a shallow flat bottom dish containing distilled water, the depth of immersion of the brick being not less than 2.5 cm. The whole arrangement shall be allowed to stand in a warm (e.g. 18° C to 30° C) and well ventilated room until all the water in the dish evaporated. When the water has been absorbed and the bricks appear to be dry a similar quantity of distilled water shall again be placed in the dishes and same allowed to evaporate as before. At the end of this period, the bricks shall be examined for efflorescence.

_Report of Test Results:_ The liability to efflorescence shall be reported as 'nil', 'slight', 'moderate', 'heavy' or 'serious', in accordance with the following definitions:

(a) Nil: When there is no perceptible deposit of efflorescence,

(b) Slight: When not more than 10 percent of area of the brick is covered with a thin deposit of salts,
(c) Moderate: When there is a heavier deposit that under 'slight' and covering up to 50 percent of the area of the brick surface but unaccompanied by powdering or flaking of the surface,

(d) Heavy: When there is a heavy deposit of salts covering 50 percent or more of the brick surface but unaccompanied by powdering or flaking of the surface, and

(e) Serious: When there is a heavy deposit of salts accompanied by powdering and/or flaking of the surfaces and tending to increase with repeated wettings of the specimen.

b) Field Test for Efflorescence: Five bricks shall be selected at random from the sample of bricks obtained as already described in testing of bricks section above.

Procedure: Each brick shall be placed on end in a shallow dish containing clean potable water. The quantity of water in the dish shall be such that the brick is immersed to a depth of not less than 2.5 cm. The brick shall be allowed to stand in this position for a few days under atmospheric conditions and room temperature until all the water in the dish is evaporated. When the water has been absorbed and the bricks appear to be dry, a similar quantity of clean potable water shall be placed in the dishes and the same allowed to evaporate as before. At the end of this period, the bricks shall be examined for efflorescence.

Report: The liability to efflorescence shall be reported as 'nil', 'slight', 'moderate', 'heavy' or 'serious' in accordance with the definition given above.

(iv) Test for Determination of Compressive Strength of Bricks

Sampling: Five whole bricks shall be selected at random from the sample of bricks obtained as already described in testing of bricks section above.

Procedure: The bricks shall be immersed in water at 25°C to 29°C for 24 hours. They shall then be removed and allowed to drain at room temperature for about five minutes and wiped free from surplus moisture. Their frogs shall be filled with mortar composed of one part Portland cement and one and a half parts clean, coarse sand graded to 0.3 cm and down. The bricks shall then be stored under damp sacks for 24 hours. After the expiry of this period, they shall be immersed in water for seven days.
At the end of seven days, the samples of bricks shall be taken out, wiped dry and placed with the flat surfaces horizontal and the mortar filled face upwards between 2 three-plywood sheets each, approximately 0.3 cm thick and carefully centered between the plates of the compression testing machine. The compression plate of the testing machine shall have a bell-seating in the form of a portion of a sphere, the centre of which coincides with the centre of the face of the plate. The load shall be applied axially at the uniform rate of approximately 140 kg per sqcm per minute until failure occurs.

**Evaluation and Report of Test:** The maximum load at failure divided by the area of bricks shall be taken as the compressive strength.

The arithmetic mean of the compressive strength of the five bricks tested shall be taken as the compressive strength of the lot. The compressive strength of the bricks shall be expressed in kg per sqcm.

### 10.1.1.1.2.2 Second Class Bricks

Second class bricks shall conform to the following specifications:

(a) They shall be as well burnt as first class bricks or slightly over-burnt, but not vitrified in any part.

(b) They must give a clear ringing sound when struck.

(c) They may have slight irregularities in size, shape and colour provided these irregularities are not such as to give uneven courses when used for construction.

(d) They may have slight chips, flaws or surface cracks but must be free from lime or Kankar nodules, and be homogenous in texture.

(e) The minimum crushing strength of second class brick shall be 70 kg per sqcm when tested according to the test prescribed in testing of bricks section (iv) above. The crushing strength of an individual brick shall not fall below the average strength by more than 20%.

(f) They shall not show any appreciable sign of efflorescence either in dry state or subsequent, to soaking in water as per test prescribed in testing of bricks section (iii) above.

### 10.1.1.1.2.3 Brick Tiles

#### 10.1.1.1.2.3.1 Flat brick tiles

Flat brick tiles shall conform to all the detailed specifications for first class bricks except that no frogs shall be provided unless specifically ordered by the Engineer. Tiles shall be made to the following dimensions:
### S. No. | Description | Size of metric tiles

(a) | Tiles for 1st class mud roofing. | 29 cm x 14 cm x 3 cm
(b) | Tiles for 2nd class mud roofing and for flooring and canal lining. | 29 cm x 14 cm x 5 cm
(c) | Tiles for flooring, tile-facing and tile-brick masonry. | 19 cm x 9 cm x 4 cm
(d) | Permissible tolerance in sizes. | ± 6.5 mm for length
     | | ± 3 mm for width
     | | ± 1.5 mm for thickness

10.1.1.2.3.2 Tiles may be machine-moulded if so, specified by the Engineer at the time of calling tenders. Where nothing specific is mentioned, tiles will mean hand-moulded tiles.

10.1.1.3 Storage

Bricks shall not be dumped at site. They shall be stacked in regular tiers as they are unloaded, to minimise breakage and defacement. The supply of bricks shall be so arranged that, as far as possible, at least two days requirements of bricks are available at site at any time. Bricks selected for use in different situations shall be stacked separately.

10.1.2 Mortars

Mortar of specified proportions shall be used for brick work and shall comply with specifications as given in the section 8.2.2.5 above.

10.1.3 Sand

The sand used for brick work shall comply with specification given in section 8.1.2.2.2 above.

10.1.4 Bitumen

The bitumen used for brick work shall comply with specification given in section 8.2.2.6 above.

10.1.5 Water

Water used for brick work shall comply with specification given in section 8.1.2.3 above.

10.1.2 Soaking
Bricks required for brickwork in cement or lime mortars, shall be thoroughly soaked in clean water immediately before use for one hour or till the complete cessation of air bubbles whichever is later, in brick-lined or steel tanks of sufficient size. Bricks shall be placed in the tank by hand, one at a time, and not thrown or tipped in. The soaked bricks shall be kept on wooden planks or brick platforms to avoid earth being smeared on them. Bricks need not to soaked for brickwork in mud mortar.

10.1.3 Laying

10.1.3.1 Brick work shall be laid in English Bond (Fig. 15) unless otherwise specified with frogs upwards. Half or cut bricks shall not be used except where necessary to complete the bond. Closers in such cases, shall be cut to the required size and used near the ends of the walls.

10.1.3.2 In exposed brick work, selected bricks of the specified class shall be used for the face work.

10.1.3.3 A layer of mortar shall be spread on full width over a suitable length of the lower course. Each brick shall be properly bedded and set home (in position) by gently tapping with handle of trowel or wooden mallet. Its inside faces shall be buttered with mortar before the next brick is laid and pressed against it. On completion of a course, all vertical joints shall be fully filled from the top with mortar.

10.1.3.4 The walls shall be taken up truly plumb. All courses shall be laid truly horizontal and vertical joints shall be truly vertical. Vertical joints in alternative courses shall come directly one over the other. Thickness of brick courses shall be kept uniform and for this purpose wooden straight edge with graduations indicating thickness of each course including joint shall be used. The height of window sills, bottom of lintels and other such important points in the heights of the wall shall be marked on the graduated straightedge.

10.1.3.5 Both the faces of walls of thickness more than one brick length shall be kept in proper plane. All connected brick work shall be carried up simultaneously and no portion of work shall be left more than one metre below the rest of the work. Where this is not possible, in the opinion of the Engineer, the work shall be raked back according to bound (and not toothed) at an angle steeper than 45°. The work done per day should not be more than one metre height.

10.1.3.6 All iron fixtures, pipes, outlets of water, hold-fasts of doors and windows, which are required to be built up into the walls shall be embedded in mortar or cement concrete as specified in their correct position, as directed by the Engineer, as the work proceeds.
10.1.3.7 The flue of the chimney shall be pargeted i.e. plastered with mud gober (cow dung) mortar [3 mud : 1 gober (cow dung)] as the work proceeds. Nothing extra shall be paid for this pargetting.

10.1.4 Joints
All horizontal joints shall be parallel and, unless otherwise specified, truly level. All vertical joints shall be truly vertical and shall come directly over one another in alternate courses. The vertical joints shall also in every other course be perpendicularly in line on the internal as well as the external face. The thickness of joints shall be as follows:

<table>
<thead>
<tr>
<th>Non Metric Bricks</th>
<th>Metric Brocks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thickness of joints shall be ¼ inch and shall not exceed 3/8 inch. The height of four courses (and four joints) as laid, shall not exceed by more than 1¼&quot; the height of four bricks as piled dry one upon the other. For exposed brickwork, wherever so specified, the mortar bed joints will be 5/16 inch thick and vertical joints ¼ inch thick, brickwork in four courses including four bed joints to rise 12 inches.</td>
<td>Thickness of joints shall be 8 mm and shall not exceed 12 mm. The height of five courses (and five joints) as laid, shall not exceed by more than 5 cm the height of five bricks as piled dry one upon the other. The thickness of joints shall be regulated so that height of five courses with five joints to rise 50 cm.</td>
</tr>
</tbody>
</table>

10.1.5 Scaffolding
For all exposed brick work or tile work, double scaffolding having two sets of vertical supports shall be provided. The supports shall be sound and strong, tied together with horizontal pieces over which scaffolding planks shall be fixed.

For all other brick work in building, single scaffolding shall be permitted. In such cases, the inner end of the horizontal scaffolding pole shall rest in a hole provided only in the header course for the purpose. Only one header for each pole shall be left out. Such holes for scaffolding shall, however not be allowed in pillars/columns less than metre in width, or immediately near the skew backs of arches. The holes left in masonry works for scaffolding purposes shall be filled and made good before plastering.

Note: In case of special type of brick work, scaffolding shall be got approved from Engineer in advance.

10.1.6 Condition of equipment
All equipments used for making or transporting mortar and bricks shall be clean and free from set mortar, dirt or other injurious foreign substances.

10.1.7 Curing

Brick work shall be protected from rain by suitable covering when the mortar is green. Masonry work in cement mortar, composite lime mortar, lime mortar (lime of category other than C&D) shall be kept constantly moist on all faces for a minimum period of seven days. Brick work carried out during the day shall be suitably marked indicating the date on which the work is done so as to keep a watch on the curing period. In case of masonry with fat lime mortar curing shall commence two days after laying masonry and shall be protected during construction from rain or uneven drying. No curing is required for Brick work in Mud mortar.

10.1.8 Finishing

10.1.8.1 General

The surfaces can be finished by ‘Jointing’ or ‘Pointing’ or by ‘Plastering’ as given on the drawings.

For a surface which is to be subsequently plastered or pointed, the joints shall be squarely raked out to a depth of 15 mm while the mortar is still green. The raked joints shall be well brushed to remove dust and loose particles and the surface shall be thoroughly washed with water, cleaned and wetted.

10.1.8.2 Jointing

In jointing, the face joints of the mortar shall be worked out while still green to give a finished surface flush with the face of the brick work. The faces of brickwork shall be cleaned to remove any splashes of mortar during the course of raising the brick work.

10.1.8.3 Pointing

For pointing, the mortar shall be filled and pressed into the raked out joints, before giving the required finish. The pointing shall then be finished to proper type given on the drawings. If type of pointing is not mentioned on the drawing the same shall be ruled pointing. For ruled pointing after the mortar has been filled and pressed into the joints and finished off level with the edges of the bricks, it shall while still green be ruled along the centre with a half round tool of such width as may be specified by the Engineer. The superfluous mortar shall then be cut off from the edges of the lines and the surface of the masonry shall also be cleared of all mortar.

10.1.8.4 Plastering
Plastering shall be started from top and worked down. All putlog holes shall be properly filled in advance of the plastering as the scaffolding is being taken down. Wooden screeds 75 mm and of the thickness of the plaster shall be fixed vertically 2.5 metres to 4 metres apart to act as gauges and guides in applying the plaster. The mortar shall be laid on the wall between the screeds using the plaster's float and pressing the mortar so that the raked joints are properly filled. The plaster shall then be finished off with a wooden straight edge reaching across the screeds. The straight edge shall be worked on the screeds with a small upward and sideways motion 50 mm or 75 mm at a time. Finally, the surface shall be finished off with a plaster's wooden float. Metal floats shall not be used.

When recommencing the plastering beyond the work suspended earlier the edges of the old plaster shall be scraped, cleaned and wetted before plaster is applied to the adjacent areas.

No portion of the surface shall be left out initially to be patched up later on.

The plaster shall be finished to a true and plumb surface and to the proper degree of smoothness as required by the Engineer.

The average thickness of plaster shall not be less than the specified thickness. The minimum thickness over any portion of the surface shall not be less than the specified thickness by more than 3 mm.

Any cracks which appear in the surface and all portions, which sound hollow when trapped, or are found to be soft or otherwise defective, shall be cut out in rectangular shape and re-done as directed by the Engineer.

10.1.8.5 Curing of finishes

Curing shall be started as soon as the mortar used for finishing has hardened sufficiently not to be damaged when watered, shall be kept wet for a period of at least 7 days. During this period, it shall be suitably protected from all damages.

10.1.8.6 Scaffolding for finishes

Stage scaffolding shall be provided for the work. This shall be independent of the structure.

10.1.8.7 Building during frosty weather

As a rule, brick work shall be suspended during frosty weather, as the stability of the same is endangered by the disintegration of the mortar by the frost while it is wet. When, however, the work is urgently required, it should be built in cement mortar, as it sets more rapidly than lime mortar, but all the freshly built portions should be
carefully covered and protected on any recurrence of the frost, and always during the suspension of work for the night.

10.2 Half Brick Masonry

10.2.1 When and how used

When it is necessary to economise on space or to reduce dead weight, partition walls of half brick thickness or even less are constructed. Such walls shall bear no weight except their own. When built on suspended floors, there must be a beam underneath to take the load, or the floor itself designed to take its load. In modern construction, these partition walls are also provided at the ground floor to effect saving on space and cost. In such cases, these walls may be built on shallow foundations or even on the floor itself. Thickness of these walls shall be:

a) 4-½" or 3" in case of wall built with non-metric bricks, and
b) 10 cm or 5 cm case of wall built with metric bricks.

10.2.2 Hoop iron reinforcement

Wall of thickness 5 cm or 7.5 cm shall invariably be constructed with hoop iron reinforcement. Wall of thickness 10 cm shall be constructed without hoop iron reinforcement when any of the following conditions exist:

a) The height is not more than 2 meters.
b) The supported length is not more than 3 metres.
c) The work is in first storey below plinth level.

In all other situations, this partition wall of thickness 10 cm shall be reinforced with hoop iron. The hoop iron reinforcement shall be 25 mm wide and 1.6 mm thick. The hoop iron band shall be embedded in cement mortar as follows:

a) Wall constructed with metric bricks - every third course.
b) 4½" thick wall constructed by non-metric bricks - every 4th course.
c) 3" bricks wall constructed with non - every 3rd course.

The hoop iron shall be hooked (give in double lap) with minimum of 20 cm hooks, at all angled junctions. Hoop iron band shall be continued for 20 cm into the main wall on which the partition wall abuts, 5 cm length of the hoop iron being bent up or down so as to take a firm grip of the brick work.

Before laying the hoop iron, it shall be cleaned of rust and loose flakes with wire brush. The hoop iron shall lie quite flat on the mortar. Half the mortar for the joint shall first be laid and other half laid after the hoop iron has been laid into position so
that it is fully embedded in the mortar. When hoop iron is not available, the Engineer may allow equivalent reinforcement in the form of rods.

10.2.3 Materials and construction

Brickwork shall be built with bricks laid in specified mortar. The work being carried out according to the specification for the class of brickwork specified, with the difference that all courses shall be laid with stretchers.

10.3 Honey-comb Brick Work

10.3.1 Material

The honey comb brickwork shall be constructed with specified class of bricks which shall be laid in specified mortar.

10.3.2 Thickness and Opening

The thickness of honey-comb brick shall be equal to half-brick or one brick as ordered by the Engineer. The size of opening shall be as follows:

a) Half brick thick honey-comb brickwork: In case of non-metric bricks, the width of opening shall be 4½” and height 3” so that each brick has a minimum bearing of 2¾” on either side. In case of metric brick, width as well as height of the opening shall be 10 cm, so that each brick has a bearing of 5 cm on either side.

b) One brick thick honey-comb brickwork: In case of non-metric bricks, width of opening shall be 2½” and height shall be 3” so that each brick shall have a bearing 1” on either side. In case of metric brick, the width of opening shall be 6 cm and height shall be 10 cm, so that each brick shall have a bearing of 2 cm on either side.

10.3.3 Laying

The honey-comb brickwork shall be laid in the specified mortar and all joints and edges shall be struck flush to give even surface.

10.4 Brick drip course

Brick drip course shall be laid above the junction of the roof with the parapet wall (Fig. 16).

Specially moulded brick shall be laid for drip course. When such special bricks are not available, bricks cut to shape may be permitted. The shape of drip course shall be as shown in Fig. 16.

The arrangements, shape etc. of lime concrete gola below the drip course to prevent water seepage through the junction of roof and wall are shown in Fig. 16.

10.5 Moulding and cornices
Specified quality and class of bricks shall be used for the work. The bricks used for moulded work shall be either purpose moulded or cut to required shape.

Cornices shall not ordinarily project by more than 15 cm to 20 cm. This projection shall be formed by projecting each layer of brick by not more than one fourth of the length of bricks. Where cornices of greater than 20 cm. is required special arrangements such as metal cramps shall be used; which shall be paid for separately.

Corbelling shall be brought roughly to required shape by plastering with the specified mortar. The mouldings shall be brought to shape using metal or wooden templates, while the mortar is still green. The mouldings shall be cured properly for seven days and the work shall be properly protected against damages by rain etc.

10.6 Chamfering of bricks

In the case of brick work where a specified shape is required chamfering or cutting is to be done which shall be paid extra.

10.7 Measurements

10.7.1 General

All brick work shall be measured net, in decimal system, as fixed in its place subject to tolerances mentioned below. Any work done extra over the specified dimensions shall be ignored.

Dimensions shall be measured correct upto 0.01 metre, areas shall be worked out correct upto 0.01 square meter, and volumes shall be worked out correct upto 0.01 cubic metre.

The thickness of brick walls upto and including 75 cm thickness shall however be measured in multiples of half brick, viz:

i) for brick work with modular brick it shall be in multiples of 10 cm.

ii) for brick work with conventional FPS bricks it shall be in multiples of 11.2 cm

iii) for brick with FPS large size bricks it shall be in multiples of 12.5 cm.

Beyond 75 cm thickness the actual thickness of wall be measured.

If for any reason the thickness of wall is required to be a specific thickness not being a measured simple multiple of half brick the thickness of wall shall be taken as the next higher multiple of half brick by more than 2 cm. In the latter case actual specified thickness shall be.
Walls of half brick thickness or less shall be described as half brick wall stating its thickness and measured separately in square metres. The following shall be taken as half brick measurement:

<table>
<thead>
<tr>
<th>For bricks 19 x 9 x 9 cm</th>
<th>10 cm</th>
</tr>
</thead>
<tbody>
<tr>
<td>For bricks 19 x 9 x 4 cm</td>
<td></td>
</tr>
<tr>
<td>For bricks 9 x 4-3/8&quot; x 2-3/4&quot;</td>
<td>4½&quot; or 11.5 cm</td>
</tr>
<tr>
<td>For bricks 9 x 4-3/8&quot; x 1-3/4&quot;</td>
<td></td>
</tr>
<tr>
<td>For bricks 10 x 4-7/8&quot; x 3&quot;</td>
<td>5&quot; or 12.5 cm</td>
</tr>
<tr>
<td>For bricks 10 x 4-7/8&quot; x 2&quot;</td>
<td></td>
</tr>
</tbody>
</table>

Corbels, string courses, projecting pilasters, aprons and friezes, sills, comices, drip courses, over-sailing courses and other projections etc. of splayed bull nozed or any other type of purpose made or cut bricks shall be fully described stating dimensions of each and measured in running metres.

Reinforced brick work shall be kept separate from plain brick work. Reinforcement shall be measured separately unless specifically included in the items of brick work as in the case of half brick masonry wall reinforcement.

The work in the following situations shall be measured separately:

a) Foundations & plinths.

b) Super-structures above plinth level upto floor two level.

c) Super-structures above floor two level.

d) Square and rectangular pillars.

e) Circular pillars.

f) Curved in plan upto mean radius not exceeding 6 mtrs.

g) Tapered surfaces of brick masonry.

h) (i) In or under water or liquid mud.

  (ii) In or under foul conditions.

Note: Brickwork in parapet shall be included in the corresponding masonry item of the storey immediately below the floor above which the parapet is built.

No deduction shall be made from the quantity of brickwork, nor any extra payment made for embedding in masonry of making holes, in respect of the following items:

i) Ends of joists, beams, pivots, girders, rafters, purlins, trusses, corbels, steps etc. whose cross sectional area does not exceed 500 sqcm.
ii) Opening not exceeding 1000 sqcm.
iii) Wall plates and bed-plates of slabs, chajjas and the like whose thickness does not exceed 10 cm and bearing does not extend to the full thickness of wall.
iv) Drainage holes, and recesses for cement concrete blocks to embed hold-fasts for doors windows etc.
v) Iron fixtures, pipes upto 300 mm dia, hold-fast of doors and windows built into masonry.
vi) Forming chases of section not exceeding 350 sqcm in masonry.

Masonry (excluding refractory brickwork) in chimney breasts, chimney stacks, smoke or air flues upto 0.25 sqm sectional area shall be measured as solid and no extra payment shall be made for pargetting and coring such flues. Where flues exceed 0.25 sqm in sectional area deduction shall be made from the same and pargetting shall be paid for separately.

Apertures for fire places shall not be deducted nor shall extra labour required to make splaying of jambs, throating and making arches over the aperture shall be paid for separately.

10.7.2 Half brick masonry
The work shall be measured in square metres.

10.7.3 Honeycomb brickwork
Honeycomb work shall be given in square metres. The full area of honeycomb work shall be measured without deduction for opening.

10.7.4 Brick drip course
The drip course shall be measured in running metres.

10.7.5 Moulding and cornices
The sectional periphery of mouldings and cornices shall be measured in centimeters along the curve (excluding the portion in contact with the wall). The length shall be measured in metres. The unit for payment shall be per cm of periphery, by per metre length of the mouldings and cornices, measured as above.

10.7.6 Chamfering of bricks
Chamfering should be measured in running metre, correct to a centimeter.

10.7.7 Square or rectangular pillar
Square or rectangular pillar shall mean a detached masonry portion square or rectangular in section such that its breadth does not exceed three times its thickness and the thickness itself does not 60 cm. The measurement shall be done as for brick
work-General. Extra payment shall be allowed for pillars over and above the rate for brick work in walls.

10.7.8 Circular pillars

Circular pillar shall include other forms of curved sections such as elliptical, partly straight and partly curved sections but shall not include intricate moulding work. The work shall be measured net as per actuals. Extra payment shall be allowed for circular pillars over and above the rate for brick work in wall.

10.7.9 Tapered walls

Measurement for tapered walls shall be as per actual work done but extra payment shall be allowed for tapered walls over and above the rate for brick work.

10.7.10 Curved masonry

Curved masonry shall include masonry which has a circular shape or other form of curve, in plan, having a minimum radius of curvature not exceeding 6 m. This shall be measured as per actual work done. The length in plan shall be measured along the mean radius. Curved masonry larger than 6 m radius in plan shall be measured under brick work general.

10.8 Rate

The rate shall include the cost of all the materials and labour as described in the respective items of work for all the operations as detailed in the respective specifications for the various items of work. The rate also includes carriage of materials upto 1 km by mechanical transport and upto 100 metres by head load, including the cost of re-handling of material within 100 metres. The labour rate as well as through rates include the cost of water. In case water is supplied free by the Department, the rate shall be reduced accordingly.

The labour rate includes the cost of water, tools and plants (scaffoldings), labour and material, and cost of good earth for mud mortar. Contractor’s profit @ 10% and overhead charges @ 5% has separately been added in the rates.

Separate rate for 1st class and 2nd class brick work shall be paid as mentioned in the Schedule of Rates.

For additional items, rates as mentioned in the Schedule of Rates shall be paid.

Extra rate for laying brick work under following situations shall be paid as mentioned in the Schedule of Rates:

a) In or under water and/or liquid mud excluding cost of bailing out or pumping out water to remove slush.
b) In or under foul conditions.

10.9 Precautions to be taken to prevent cracks in buildings

In order to minimise cracks in buildings, the following measures shall be adopted subject to the approval of the Engineer.

10.9.1 Horizontal cracks in masonry and plaster at the floor or roof slab level

10.9.1.1 A smooth bearing for RCC slabs and beams on the wall with 6 mm cement plaster 1:3 (1 cement : 3 fine sand), finished with a floating coat of neat cement shall be provided and then finished with a thick coat of lime wash or Kraft paper. The sides and top of slabs and beams in contacts with walls shall be painted with thick coat of hot bitumen.

10.9.1.2 The slab shall not bear on full thickness of external wall. A gap of about 12 mm shall be kept between slab and external masonry and filled with bituminous filler or impregnated fibre board in case of Superior buildings and bituminous filler (80 kg hot bitumen : 1 kg cement : 0.25 cubic metre coarse sand) in other buildings. The external masonry of all beyond the expansion joint shall not be less than 10 cm. Please see Fig. 17.

10.9.1.3 A similar gap of 12 mm wide shall be provided and filled with impregnated fibre board or bituminous filler when two slabs about against each other and bear on an internal wall. Such expansion joints should always be provided at ridges (and not in valleys) as shown in Fig. 18.

10.9.1.4 Ceiling plaster shall be done first, and then the wall plaster. When the ceiling plaster is done, it shall be finished with a chamfered edge at an angles at its junction with the wall at bearing with a trowel while the plaster is being done it shall be kept separate from the ceiling plaster by a thin straight groove drawn with a trowel at an angle with the wall, while the plaster is still green. The arrangement is shown in Fig. 17 to 20.

10.9.1.5 RCC or plain cement concrete 1:2:4 bed plate with a smooth surface and a thick cost of lime wash or laid with Kraft paper shall be provided under the beams. The plaster of wall and the bed plate shall be kept separate from that of the beam given in Fig. 20. Minimum thickness of RCC bed plate shall be 10 cm and that of plain concrete 20 cm.

10.9.2 Horizontal cracks at the junction of sun shades with the wall

Wall plaster shall be kept separate from that of the RCC sun shade as in 10.8.1.4 above.

10.9.3 Inclined cracks at the junctions of sun shades with the wall
10.9.3.1 Flat brick arches shall be constructed for opening upto 1.2 metres.

10.9.3.2 RCC lintels shall be allowed to dry and shrink as much as possible before plastering the wall.

10.9.4 Vertical cracks at the bearings of RCC beams or pillars

These cracks occur when RCC beam has an expansion joint over the masonry pillar. These can be avoided by designing a continuous beam on the pillar. Where however, expansion joint in beam is essential a RCC bed plate may be provided over the pillar for its full length and width.

10.9.5 Transverse cracks in RCC slab in sun shades, verandahs and room

Expansion joints shall be allowed at 5 to 6 metres intervals in case of sun shades 12 to 13 metres in case of covered verandah slabs and 12 to 15 metres in case of slabs continuous over rooms in a row of quarters.

To prevent cracks in the masonry, below or above the expansion joints, the following measure shall be taken:

10.9.5.1 Sun Shades

In this case, the expansion joints shall not extend to the portion embedded in masonry but shall stop short of the face of the wall by 5 cm and the distribution reinforcement in the embedded portion and in the 5 cm portion of the chajja slab where there is no expansion joint, shall be increased to 40% of main reinforcement. The gap of the expansion joint in the projected portion shall not be filled with any material.

10.9.5.2 Verandah Slabs

In this case, the expansion joint shall be a neat but joint which shall be finished straight. The joint shall be carried right through the portion embedded in the masonry also. It is desirable to provide a vertical but joint in the masonry supporting the verandah slab at the expansion joints from plinth level. Where this is not possible, R.C.C. or plain cement concrete bed plates shall be provided on the bearing as shown in Fig. 20. To prevent cracks in the masonry above, the longitudinal wall shall have also a butt joint with gap running in the same vertical plane as the joint in the slab. The gap can, in the case of roof slabs, be sealed by copper cradles.

10.9.5.3 Room Slabs

In load structure, expansion joint in room slabs shall be similar to that in verandah slabs. Where slab is combined with T-Beams, the expansion joint shall be provided by substituting one of the T-beams, with rectangular beam and slabs as per Fig. 21.
In RCC framed structure, the expansion joint is generally provided in conjunction with twin beams and twin column as shown in Fig. 21 and 22. The expansion joint shall be provided with copper cradle and its top filled with bituminous materials. The underside of the beam shall be provided with sheet of asbestos or any other suitable material, which shall be fixed on one side and shall be free to move on the other side within oval shaped holes, in case of twin columns, the expansion joint is similarly covered on the inside and outside.

The gap between the twin column and the gap below copper cradle in twin beams need not be filled with any bitumen filler but may be kept unfilled. Before however, the joint covered on the outside with asbestos or any other suitable sheets, the gap should be cleaned thoroughly of all rubbish or mortar droppings etc.

10.9.6 Cracks at the junction of new building with old

When making additions to an old building, if new masonry is toothed with old masonry there is a likelihood of cracks occurring at the junction because of differential settlement. Toothing therefore shall be avoided and new masonry shall be laid with a slip joint, for thick walls. Where tongued and grooved joint is not possible as in 20 cm walls, the joint shall be straight butt joint only.

10.9.7 Cracks in general

10.9.7.1 Masonry work shall be proceeded systematically and uniformly at all levels.

10.9.7.2 The plaster work on walls shall be deferred as much as possible so as to let shrinkage in R.C.C. and masonry take place before plastering.

11. FLOORING

11.1 General Specification

11.1.1 Sand Filling

The earth filling shall be stopped at such a height as to allow of full thickness of sand, or cement concrete and the correct thickness of surfacing. In areas, where the water table is near the ground surface, a suitable treatment shall be provided to prevent the rise of moisture into the floor. This treatment shall be paid for separately.

11.1.2 Base Concrete

Base concrete shall be laid in accordance with the specifications laid in section 8 above, in one operation in a uniform layer, absolutely true and parallel to what is required on the finished surface and to the satisfaction of Engineer.

11.1.3 Levelling
A reference level mark shall be marked all-round on the walls (15 cms) or so above the floor level with the help of a water level. Water level consists of a can of water connected with a rubber tubing to a glass tube, which shows the level of water in the can. With the help of this level, true horizontal lines shall serve as a datum from which all levels for base layer and topping etc. shall be measured off.

11.1.4 Paving to Bond with Base Concrete

The finishing surface or paving shall not be laid before the base concrete, has set for at least seven days. While the surface is still soft enough to receive and retain the impression, it should be brushed with stiff-bristled broom. This is very necessary in order to remove laitance, scum and inadequately embedded coarse aggregate.

In addition to the brushing, scour and pit the surface so as to provide mechanical bond for the topping. During the interval between the finish the base shall be thoroughly cured and protected from the deposition of grease, pitch paint or any other foreign substance. Also immediately prior to the placing of the finishing topping, the base course shall be roughened with steel wire brushes without disturbing the concrete and wetted. It shall be ensured that the surface of the base course is absolutely free from the surplus water, laitance and other foreign matter.

11.1.5 Surface to be passed

The surface of the screed bed or base concrete shall be passed by the Assistant Engineer before the wearing coat.

11.1.6 Flooring to continue under Doorway and Fireplace

The brickwork or masonry shall be kept down sufficiently under all archways, doors and fireplaces to admit the depth of finishing surface being carried through. Joints must be given at this place, however, to avoid unsightly cracks due to any uneven settlement. The offsets walls, pillars etc. shall be kept down sufficiently under to admit the full depth of both the finishing surface and the base below it being carried through.

11.1.7 Levels and Slopes

Unless otherwise specified, all floors shall be perfectly level, except bathroom and verandah floors, which shall have an outward slope of 1 in 60. The layers of sand concrete shall be uniform in thickness and any slope required is to be obtained by marking the outer walls lower than the inner ones by the necessary amounts.

11.1.8 Straight Edges and Spirit Levels

The Contractor shall provide and keep available wherever flooring work is proceeding, straight edges of a length not less than 2.5 metres and with parallel
sides, as well a 25 cms spirit-level for the purpose of testing the trueness of the floor being laid.

Note: Specification given below for different type of flooring are in addition to the General Specifications mentioned above.

11.2 White Glazed Tiles in Flooring, Treads of Steps, and Landings

11.2.1 Material

White glazed tiles shall confirm to the specifications given below. All other materials used shall confirm to specifications given in the relevant sections or as decided by Engineer.

11.2.1.1 Glazed Tile (White, Indian make)

The tiles shall be of approved make and shall conform to IS: 777-1988. They shall be flat and true to shape and free from cracks, crazing spots chipped edges and corners. The glazing shall be of uniform shade.

The tiles shall be of nominal sizes such as 150 mm x 150 mm and 100 mm x 100 m or as specified. The thickness of the tiles shall be 5 mm, or 6 mm as specified. The tolerance on facial dimension value shall be ± 1.0 mm and ± 0.5 mm on thickness.

The top surface of the tiles shall be glazed. The glaze shall be either glossy or matt as specified. The underside of the tiles shall be completely free from glaze in order that the tile may adhere properly to the base. The edges of the titles shall be preferably free from glaze, however, any glaze if unavoidable, shall be permissible on any one edge of the tile.

11.2.1.2 Internal or External angle (Glazed)

The angles shall be of thickness not less than the tiles with which they are used. The size of the angles shall be as specified in the description of the item. The stipulated size of angled referred to the greatest width of the special measure in a straight line.

The lengths of specials shall be 15 cm, 10 cm or other standard size available conforming to the size of tiles available. In other respects, the general specifications described in 11.2.1.1 above shall be applicable.

11.2.2 Workmanship

11.2.2.1 Sub-grade

Sub-grade shall be of concrete or of R.C.C. slab.

11.2.2.2 Bedding

Bedding over which the tiles shall be laid shall be of 12 mm average thickness in cement mortar 1:3 (1 cement: 3 coarse sand).
11.2.2.3 Laying

Sub-grade shall be cleaned, wetted and mopped. The bedding shall be laid evenly over the surface, tamped and corrected to desired levels and allowed to harden enough to offer a rigid cushion to tiles and to enable the mason to place wooden planks across and squat on it. Before laying the tiles grey cement slurry or honey like consistency at 3.3 Kg/square metre shall be applied over the bedding. At a time in area to accommodate about twenty 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 line with adjoin tile. The joints shall be as thin as possible in straight line or as per the pattern. The surface of the flooring shall be checked with a straight edge about 2 m long so as to obtain a true surface with the required slope.

Where full size tiles cannot be fixed, these shall be cut (sawn) to the required size and their edges rubbed smooth to ensure straight and true joints. Tile fixed in the floor near the wall shall enter plaster, skirting or dado to a minimum depth of 10 mm. After laying the tiles, excess cement grout is cleaned.

11.2.2.4 Jointing and finishing

The joints shall be cleaned of grey cement grout with wire brush or trowel to a depth of 5 mm and all dust and loose mortar removed. White cement shall then be used for flush pointing the joints. The floor shall be cured for seven days. The surface then be washed and cleaned. The surface shall not sound hollow when tapped.

11.2.3 Measurements

White glazed tiles shall be measured in square metres correct to two places of decimal. Length and breadth shall be measured correct to 1 cm between the exposed faces of skirting or dado where the junction of flooring with skirting or dado is square.

11.2.4 Rate

11.2.4.1 General

The rate shall include the cost of all materials and labour involved in all the operations des cribbed above for completing the work as per specifications and as per schedule.

11.2.4.1.2 The through rates include the carriage of all materials upto a distance of 100 meters on head load and 1 kilometre by mechanical transport. The rates of items involving terrazzo/glazed tiles have been worked out on the basis of rates as at district headquarters of Uttarakhand Pradesh State. All other carriage shall be counted for separately depending upon locations of site of the work. The through rates include
all wastage and the labour rates include the charges on account of form work, tools and plants, scaffolding, sundries and water charges etc.

11.2.4.1.3 The rates are applicable for laying of flooring upto floor two. For every subsequent storey-height, an additional rate of 1% above through rates should be added.

11.2.4.1.4 The rate includes water charges, contractor’s profit @10% and overhead charges @5%. The rate does not include the cost of sub-grade if provided in specifications unless otherwise specified. Dividing strips shall be paid separately as mentioned in the latest applicable UKPWD Schedule of Rates.

11.2.4.2 The labour rates and through rates is applicable for glazed tiles of white shade and of size 152 mm x 152 mm x 6 mm. In case, the tiles used are of size 150 mm x 75 mm x 6 mm or 108 mm x 108 mm x 6 mm the labour rates shall be increased by 50%. The through rates shall be increased by 30%.

In case the coloured glazed tiles are used, the labour rates shall remain un-changed but the through rates shall be increased by 15%. These rates are not applicable for specially decorated or fluted tiles for which special rates shall be paid, if used.

The rate also includes the cost of bedding and cement slurry applied over it. An extra rate as per schedule shall be paid for laying of white glazed tiles in treads of steps not exceeding 30 cm in width.

11.3 White Glazed Tiles in Risers of Steps, Skirting and Dado

11.3.1 Material

Material shall be as specified in 11.2.1 above.

11.3.2 Workmanship

11.3.2.1 Preparation of surface

In case of brick masonry wall, the joints shall be raked out to a depth of at least 15 mm while the masonry is being laid. In case of concrete wall, the surface shall be hauled and roughened with wire brushes. The surface shall be cleaned wetted thoroughly before commencing the laying work.

11.3.2.2 Laying

The wall surface shall be covered with 12 mm thick plaster of cement mortar 1:3 (1 cement : 3 coarse sand) mix and allowed to harden. The plaster shall be roughened when it sets initially with wire brushes or by scratching diagonal lines 1.5 mm deep at 7.5 cm c/c both ways. The back of tiles shall be buttered with grey cement slurry and edges with white cement slurry and set in bedding mortar. The tiles shall be gently tamped in position one after the other keeping the joints as thin as possible.
Top of skirting or dado shall be truly horizontal and the joints vertical or as per required pattern.

Risers of steps, skirting and dado shall rest on top of treads or flooring. Where full size tiles cannot be fixed, these shall be cut (sawn) to the required size and the edges be smoothened.

11.3.2.3 Curing and finishing

The joints shall be cleaned and flush pointed with white cement. The surface shall be kept wet for seven days. After curing the surface shall be washed clean. The surface shall not sound hollow when tapped with a mallet.

11.3.3 Measurement

Risers to steps, skirting and dado shall be measured in square metres correct to two places of decimal. Length and height shall be measured along the finished face of the skirting or dado including curves where specials such as cover, internal and external angles and beads are used. Length except in case of risers and skirting where height shall be measured correct to 3 mm.

At places where full size are not used and cut (sawn) tiles are required, extra shall be paid for the same confining the extra to the portion using cut tiles. In addition to payment for risers, skirting and dado specials such as covers, internal and external angles, beads and cornices shall be measured separately and paid for running metres.

11.3.4 Rate

The rate shall be as per specification in 11.2.4 above. The rate also includes the cost of cement plaster to be used as bedding and cement slurry used. Where tiles are to cut, an extra rate as per schedule shall be paid.

11.4 Slate Tile Cladding on Vertical/Inclined Surfaces

11.4.1 Material

All material used shall comply with specifications given below for slate, and for cement mortar etc., the specifications given in other relevant sections above shall apply.

11.4.1.1 Slate

11.4.1.1.1 General

The slate shall be flat properly squared to the specified size with firm sides and not liable to fracture when holed. They shall be tough, hard, sonorous on being struck, rough to the touch, free from flaws or cracks, non-absorbent and of uniform
thickness. The quarry from which the slates are obtained shall be subject to the approval of the Engineer.

The slating nails shall be of copper or of non-rusting composition approved by the Engineer.

11.4.1.1.2 Sizes and Pitches

The size of slates given below shall not be laid at pitches flatter than those given against each other, nor must the pitch be greatly in excess of that given or undue strain is put upon the nails:

<table>
<thead>
<tr>
<th></th>
<th>60 cm x 30 cm pitch</th>
<th>22 Degrees</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1)</td>
<td>50 cm x 25 cm pitch</td>
<td>27 Degrees</td>
</tr>
<tr>
<td>(3)</td>
<td>40 cm x 20 cm pitch</td>
<td>33 Degrees</td>
</tr>
</tbody>
</table>

11.4.1.1.3 Specific Gravity

The specific gravity of slate shall be 2.89.

11.4.1.1.4 Compressive Strength

The compressive strength of the slate shall be 770 to 2110 kg/sqcm.

11.4.1.1.5 Uses

The slates are used as roofing and flooring material. Harder varieties of slates are used for dado work and steps of stairs.

11.4.2 All other specifications for workmanship shall be the same as specified in the section 11.3 above and as per nomenclature in the Work item including exceptions to be followed in workmanship as mentioned below and as directed by the Engineer for the desired pattern of slate roof work.

11.4.2.1 Double slate roofing

11.4.2.1.1 Laps

The laps, or the distance by which a slate overlaps the next but one below it, shall in no case be less than 75mm.

11.4.2.1.2 Placing

All slates shall butt close to each other, with the rough side uppermost. Every nail shall be covered by the covering slate, except in the eaves course.

11.4.2.1.3 Ridge concrete

The top edge of the slates on each side of the ridge shall rest on the ridge plate, the top of which shall be played to the roof slope. The slates shall be accurately cut form a straight and close joint. On the apex formed by the edge of the slates, a roll not
less than 3 inches (7.5 cm) and made of 1:2:4 cement concrete shall be formed, with the centre coinciding with the apex formed by the slates.

11.4.2.1.4 Hips

Hips shall be laid on the same manner as the ridge, unless it has been specified that these should be concealed.

11.4.2.1.5 Concealed hips

Concealed hips will be covered by lead sheets which have been cut to the length of the slate, bent over to straddle the hip batten, and fixed in position similarly to the state. The lead will be covered completely by the upper slate which must be accurately cut to form a straight and close joint.

11.4.2.2 Single slate roofing

Single slate roofing shall be laid in the same manner as double slate roofing excepting that only head nailing shall be employed, centre nailing being not feasible. The head side laps shall be at least 7.5 cms and 3.8 cms respectively.

11.4.3 Measurements

All work shall be measured net as fixed without any allowance for laps except that opening of area 0.40 sqm and under shall not be deducted. The portions of roof covered by ridge or hip coverings shall be included in the roof measurements. The ridge or hip coverings shall be measured in running meters and paid for separately.

11.4.4 Rate

The through rates for slate roofing include the cost of slates, nails, ridges, hips etc. along with cement mortar, curing etc. The labour rates cover the labour charges for the above operations.

Rates shall be as specified below, apart from as specified in section 11.3 above:

The rate includes the cost of all labour and materials involved in all operations for completing the work as per specifications.

The labour rate through includes the carriage of material for 100 meters by head load and one kilometre by mechanical transport. It also includes the cost of water, tools and plants, scaffolding, cost of cement mortar, contractor’s profit @10% and over-head charges @5%. The rates also include the wastage and overlaps of slates.

11.5 Black Chamba Stone Tiles

11.5.1 Material
The material of Black Chamba Stone Tiles for flooring, treads of steps and landing, and its dimensions and surface texture/finish shall be as specified in the Work item as approved and directed by the Engineer.

11.5.2 All other specifications for workmanship, measurement, and rate shall be the same as specified in the section 11.2 above and as per nomenclature in the Work item.

12. PLASTERING AND DISTEMPERING WORK

12.1 Materials

The cement mortar to be used shall be as specified in the Work item, and shall be as per the material specifications given in section 8.2.2.5 above.

12.2 General Specifications

12.2.1 Scaffolding

For all exposed work double scaffolding having two sets of vertical supports be provided. The supports shall be sound and strong, tied together with horizontal pieces over which scaffolding planks shall be fixed.

For all other work in buildings, single scaffolding shall be permitted. In such cases, the inner end of the horizontal scaffolding pole shall rest in a hole provided only in header course for the purpose. Only one header for each pole shall be left out. Such holes for scaffolding shall, however not be allowed in pillars/columns less than one meter in width, or immediately near the skew backs of arches. The holes left in masonry works for scaffolding purposes shall be filled and made good before plastering.

For ceiling plaster, stage scaffolding shall be provided. This shall be independent of walls.

Note: In case of special type of work, scaffolding shall be got approved from Engineer in advance.

12.2.2 Tools

Tools shall be used as per IS: 1630-1984, Specifications for accessory tools for plaster work and pointing work.

12.2.3 Preparation of Back Ground

The surface shall be cleaned off all dust, loose mortar droppings, traces of algae, and other foreign matter by water or by brushing. Smooth surfaces shall be roughened by wire brushing, if it is not hard; by hacking if it is hard. In case of concrete surface, if a chemical retarder has been applied to the form work, the
surface shall be roughened by wire brushing and all the resulting dust and loose particles cleaned off and care shall be taken that none of the retarders is left on the surface.

For the durability of the plaster, it is of the utmost important to obtain a satisfactory bond between the background and the plaster coat and also ensure that the bond is maintained subsequently. Before plastering, the joints of all old brick work or masonry and of all new work in mud shall be raked out with a hook (nor a hammer or tesi) to a depth of 13 mm. New brick work or masonry in lime, or cement mortar, if it is to be subsequently plastered, shall have the joints raked out before the mortar has set. The earth and mortar dust obtained from raking the joints shall be thoroughly washed off, and the work watered for 24 hours before the plaster is applied.

Where plastering is to be done on an old backing, special care shall be taken in preparing the same for a new coat of a plaster. The crumbled layers of backing shall be completely removed and made good. If the backing contains soluble salts particularly sulphates, the application of the plastering shall be done only after the efflorescence of the salts is complete and same is thoroughly removed from surface.

For concrete surface, projecting burrs of mortar formed due to the gaps at joints in shuttering shall be removed. The surface shall be scrubbed clean with wire brushes. In addition concrete surfaces shall be pock marked with a pointed tool, at spacing of not more than 5 cm centres, the pocks being made not less than 3 mm deep, this is to ensure a proper key for the plaster. The surface shall be washed off and cleaned of all oil, grease etc., and well wetted before the plaster is applied.

The backing shall be even in order to avoid variations in the thickness of plasters. Any brickwork or masonry that projects beyond the general face of plaster shall be cut back.

All putlog holes shall be filled up in advance of the plastering, as the scaffolding is being taken down.

12.2.4 Sequence of Operations

For external plaster the plastering operations shall be started from the top floor and carried downwards. For internal plaster, the plastering operations may be started wherever the building frame and cladding work are ready and the temporary supports of the ceiling resting on the wall or the ceiling have been removed.

The surfaces to be plastered shall first be prepared as described in Clause 12.2.3 above.
The first coat shall then be applied to ceilings. After the ceiling plaster is completed and scaffolding for the same removed, the first coat shall be applied on walls. The first coat shall be under coat in case of two or three coat plaster work.

After a suitable time interval as detailed under various types of plaster in subsequent paras depending upon the type of mortar, the second coat shall be applied. Surface of the first under coat shall be adjusted and screeds laid to serve as guides in bringing the work to an even surface. After a further suitable time interval as detailed under various type of plaster in subsequent paras, the finishing coat shall be applied first to the ceilings and then to the walls.

Plastering of cornices, decorative features etc. shall be completed before the finishing coat is applied.

Where corners and edges have to be rounded off, such rounding off shall be completed along with the finishing coat to prevent any joint marks showing out later.

12.2.5 Finish

The plaster shall be laid to a true plain surface and tested frequently with a straight-edge and plumb-bob or the spirit level as the case may be. The straight-edge shall not be less than 3 meters in length. All horizontal lines and surfaces shall be tested with a level, and all jambs and corners with a plumb-bob and a masons square as the work proceeds. All mouldings shall be worked true to template and shall be neat, clean level, and parallel, or truly plumb as the case may be.

12.2.6 Precaution against Discontinuity

To prevent cracking of plaster, caused by discontinuity of backing such as changing from concrete to brickwork or changing from wall to ceiling, a neat cut through the plaster shall be applied at the junction.

12.2.7 Cleanliness and Protection

Adequate protection shall be given to all existing work and fittings, which are liable to be damaged during plastering by covering up with boards, dust sheets etc. as necessary. Care shall be taken to avoid the splashing of mortar on to neighbouring finished surfaces; any such splashes shall be cleaned off immediately. On completion, work affected by plastering operations, shall be left clean.

12.2.8 Defects

Any cracks in the plaster, or parts which sound hollow when tapped, or are found to be soft or otherwise defective after the plaster has dried, shall be cut out in rectangles or squares and re-plastered by the Contractor at his own cost.
Note: Specifications given below for different items are in addition to the general specifications described above.

12.3 Cement Plaster

12.3.1 Cement ceiling plaster

12.3.1.1 Scaffolding

This shall be as per Clause 12.2.1 above.

12.3.1.2 Preparation of surface

The surface shall be prepared as per Clause 12.2.3 above.

12.3.1.3 Mortars

Mortar of the specified mix shall be used.

12.3.1.4 Application

Ceiling plaster shall not be commenced until the slab above has been finished and centering has been removed. In the case of ceilings of roof slabs, plaster shall not be commenced until the terrace work has been completed. These precautions are necessary in order that the ceiling plaster is not disturbed by the vibrations set up in the above operations.

To ensure even thickness and a true surface, gauges of plaster 15 cm x 15 cm shall be first applied at not more than 1.5 m intervals in both directions to serve as guides for the plastering. Surfaces of these gauges areas shall be truly in the plane of the finished plaster surface. The plaster shall then be applied in a uniform surface to a thickness slightly more than the specified thickness and shall then be brought to true and even surface by working a wooden straight edge reaching across the gauges. Finally the surface shall be finished true with a trowel or with wooden float accordingly as a smooth of sandy granular texture is required. Excess trowelling or overworking of the floats shall be avoided. The plastering and finishing shall be completed within half an hour of adding water to the dry mortar.

12.3.1.5 Finish

The plaster shall be finished to a true and plumb surface and to the proper degree of smoothness as required. The work shall be tested frequently as the work proceeds with a true straight edge not less than 2.5 m long with plumb bobs. All horizontal lines and surfaces shall be tested with a level and all jambs and corners with a plumb bob as the work proceeds.

12.3.1.6 Thickness
The average thickness of plaster shall not be less than 6 mm. The minimum thickness over any portion of the surface shall not be less than 5 mm.

12.3.1.7 Curing

Curing shall be started as soon as the plaster has hardened sufficiently not to be damaged when watered.

The plaster shall be kept wet for a period of at least 7 days. During this period, it shall be suitably protected from all damages at the Contractor’s expense by such means as the Engineer may approve. The dates on which the plastering is done shall be legibly marked on the various sections plastered so that curing for the specified period thereafter can be watched.

12.3.2 Cement plaster for slab bearing

12.3.2.1 Cement plaster shall be 6 mm thick of 1:3 (1 cement : 3 sand) mix finished with a floating coat of neat cement and thick coat of lime wash on top of walls for bearing of slabs.

12.3.2.2 Application

The plaster shall be applied over the cleaned and wetted surface of the wall. When the plaster has been brought to a true surface with the wooden straight edge it shall be uniformly treated over its entire area with a paste of neat cement and rubbed smooth, so that the whole surface is covered with neat cement coating. The quantity of cement applied for floating coat shall be 2.2 kg per sqm. Smooth finishing shall be completed with trowel immediately and in no case later than half an hour of adding water to the plaster mix. The rest of the specifications as described below shall apply.

One coat plaster work:

(a) Application

The plaster about 15 cm x 15 cm shall be first applied, horizontally and vertically, not more than 2 metre intervals over the entire surface to serve as gauges. The surfaces of these gauges areas shall be truly in the plane of the finished plaster surface. The mortar than shall be laid on the wall, between the gauges with trowel. The mortar shall be applied in a uniform surface slightly more than the specified thickness. This shall be beated with thapies to ensure through filling of joints, and then brought to a true surface, by working a wooden straight edge reaching across the gauges with small upward and sideways movements at a time. Finally the surfaces shall be finished off true with a trowel or wooden float accordingly as a smooth or a sandy granular texture is required. Excessive
trowelling or overworking the float shall be avoided. During the process, a solution of lime putty shall be applied on the surface to make the latter workable. All corners, arrises, angles and junctions shall be truly vertical or horizontal as the case may be, and shall be carefully finished, rounding or chamfering corners, arrises, junctions, etc. shall be carried out with proper templates to the size required.

In suspending the work at the end of the day, the plaster shall be left, cut clean to line both horizontally and vertically. When recommencing the edge of the old work shall be scraped, cleaned wetted with lime putty before plaster is applied to the adjacent areas to enable the two to properly join together. Plastering work shall be closed at the end of the day on the body of the wall and nearest than 15 cm to any corner or arrises. It shall not be closed on the body of features such as plaster bands and cornices not at the corners, or arrises. Horizontal joints in plaster work shall not also occur on parapet tops and copings as these invariably lead to leakages. No portion of the surface shall be left out initially to be patched up later on.

(b) Curing

This shall be started 24 hours after finishing the plaster and shall be kept wet for a period of 7 days. During this period it shall be protected from all damages. The dates of plastering shall be legibly marked on various sections of the walls so that curing for the specified period thereafter can be watched.

12.3.2.3 Lime wash

This shall be applied in a thick coat after curing the plaster for three days.

12.3.3 Cement plaster on walls etc.

12.3.3.1 Preparation of mortars for plastering

This shall conform to the specification under section 8.2.2.5 above. The mortar of specified proportions shall be used.

12.3.3.2 Application of plaster

This shall conform to the specifications under Clause 12.3.2.2 (a) above except that the beating with thapies shall not be done on the cement plaster and no lime putty solution shall be applied on the face while finishing.

Cement plaster shall be used within half an hour after addition of water. Any mortar or plaster which is partially set shall be rejected and removed forth-with from the site at Contractor’s cost. In case of two or three coat plaster the under coat shall be left
rough and furrowed 2 mm deep with a scratching tool diagonally both ways to form key for finishing coat. Thickness of each coat shall be as specified.

12.3.3.3 Curing

Each coat shall be kept damp continuously till the next coat is applied or for a minimum period of 7 days. Moistening shall commence as soon as plaster is hardened sufficiently. Soaking of walls shall be avoided and only as much water as can be readily absorbed shall be used. Excessive evaporation on the sunny or windward sides of buildings in hot air dry weather shall be prevented by handing mattings or gunny bags on the outside of the plaster and keeping them wet.

12.4 Measurement

12.4.1 Ceiling Plaster

Ceiling plaster shall be measured under the following classifications.

(a) These shall be measured between the walls or partitions and the dimensions before plastering shall be taken.

(b) Ceiling at a height greater than 5 m shall be so described and shall be measured separately stating the height in stages of 1 metre or part thereof.

(c) Ceiling with projected shall be measured over beams and plastered side of beam shall be measured added to plastering on ceiling.

(d) Spherical and groined ceiling shall each be measured separately.

(e) Soffits of stairs shall be measured as plastering on ceiling. Flowing soffits (viz. portion under spiral stair case etc.) shall be measured separately.

(f) Ribs and mouldings on ceiling shall be measured as for cornices, deduction being made from the plastering on ceiling in case the width/girth of the mouldings exceed 150 mm.

12.4.2 Cement Plaster

12.4.2.1 The description of each item, unless otherwise stated includes wherever necessary, conveyance and delivery, handling, unloading, storing, fabrication, hoisting, all labour for finishing to required shape and size, setting, fitting and fixing in position, straight cutting and waste, return of packing and other incidental charges.

12.4.2.2 Preparation of back ground i.e. cleaning of masonry/concrete surface of all dust, loose mortar drooping traces of algae, efflorescence and other foreign matter and roughing by wire brushing or hacking, as may be required unless otherwise stated in included in the items and shall not be measured and paid for separately.
12.4.2.3 Raking out of joints and trimming off the projections on brick/concrete surface before plastering where necessary shall not be measured and paid for separately.

12.4.2.4 All plastering shall be measured in square meters unless otherwise specified. Length, breadth or height shall be measured correct to 0.01 metres.

12.4.2.5 Thickness of the plaster shall be exclusive of the thickness of the key i.e. grooves or open joints in brick work, stone work etc. or space between laths. Thickness of plaster shall mean the minimum thickness at any point on a surface. Dubbing out shall not be measured and paid for in the case of new work nor for rough surface of old does brick/stone masonry work where the face is in plumb as the rates for plastering include for the necessary dubbing to such surfaces.

12.4.2.6 The measurement of wall plastering shall be taken between the walls or partition (dimensions before plastering being taken) for length and from the top of floor or skirting to ceiling for height. Depth of coves or cornices if any shall be deducted.

12.4.2.7 Plastering in isolated width or in widths not forming part of general plastering work (as in bands, cornices, sunk panels etc.) shall be measured as below:

(a) 300 mm or below in width/girth in running meters.
(b) Width/girth above 300 mm in square meters.

12.4.2.8 Plastering at height greater than 10 metres above ground/datum level shall be measured separately in stages of 5 metres height except interior plastering in case of building which shall be measured for each storey.

12.4.2.9 A coefficient of 1.63 shall be adopted for the measurement of one side plastering on honey comb work having 6 cm x 10 cm opening.

12.4.2.10 Soffits of stairs shall be measured as plastering on ceilings. Flowing soffits shall be measured separately.

12.4.2.11 Sides of plasters, projections etc. shall be added to plaster on walls.

12.4.2.12 Mouldings, architraves, ceiling ribs, cornices and the like, on plasters and around opening etc. shall be measured separately as specified in 12.4.2.7 above. Length shall be measured in running metres at the centre of girth. Girth shall be measured along curve of moulding.

12.4.2.13 Moulded cornices and coves shall be measured in squared metres, the area being arrived at by multiplying length by girth.

12.4.2.14 Flat or weathered top to cornices when exceeding 15 cm in width shall not be included in the girth but measured with the general plaster work.

12.4.2.15 Deductions
For jambs, soffits, sills, etc., for openings not exceeding 0.5 square metre each in area, for ends of joints, beams, posts, girders, steps, etc. not exceeding 0.5 square metre in each area, deductions and additions shall be made in the following manner:

(a) No deductions shall be made for ends of joints, beams, posts, etc. and openings not exceeding 0.5 sqm each and no addition shall be made for reveals, jambs, soffits, sills etc. of these openings nor for finish to plaster around ends of joints, beams, posts etc.

(b) Deductions for openings exceeding 0.5 sqm but not exceeding 3 sqm each shall be made as follows and no addition shall be made for reveals, jambs, soffits, sills, etc. of these openings.

(1) When both faces of wall are plastered with same plaster, deduction shall be made for one face only.

(2) When two faces of wall are plastered with different types of plasters or if one face is plastered and the other pointed, deduction shall be made from the plaster or pointing on the side of frame for door, window, etc. on which width of reveals is less than that on the other side but no deduction shall be made on the other side. Where widths of reveals on both faces of wall are equal, deduction of 50% of area face shall be made from areas of plaster and/or pointing as the case may be.

(3) When only one face is plastered and the other face is not, full deduction shall be made from plaster if width of reveal on plastered side is less than that on unplastered side, but if widths of reveal on both sides are equal or width of reveal on unplastered side is more no deduction shall be made.

(4) For openings having door frames equal to or projecting beyond the thickness of wall, full deduction for opening shall be made from each plastered face of the wall.

(c) In case of openings of area above 3 sqm each, deduction shall be made for opening but jambs, soffits and sills shall be measured.

(d) Different quantities of plastering referred to this para shall not include “Plastering with terrazzo finish” as the method of measurement in this case is different. In such cases where the plaster on the other face consist of a plaster with terrazzo finish. Method of addition and deductions for the ordinary plaster face shall be regulated as if that face alone is plastered and the other is given an entirely different type of non-comparable treatment.
Note: In calculating areas of openings the extra width of rebated reveals, if any, shall be excluded.

12.4.2.16 Plastering on ceilings and walls shall be measured separately.

12.4.2.17 Circular work not exceeding 6 metres in radius shall be measured separately from wall plaster.

12.4.2.18 Fair joints and cutting to edges shall not be measured separately.

12.5 Rate

The labour rate includes the cost of all materials and labour required for completing the work as per specifications.

1) The labour rates and through rates include carriage up to 100 metres on head load and one kilometer by mechanical transport.

2) The labour rates include the sundry items like sand, papers scrappers, soap and soda etc., as also the water charge.

3) The labour rates also include the labour required for thoroughly mixing the mortar and all sorts of scaffolding and ladders etc.

4) The specialty paints shall be the paints which are declared as such by Chief Engineer, Uttarakhand Pradesh Public Works Department.

All items shall be paid as per latest applicable UKPWD Schedule of Rates. The rate also includes contractor’s profit @ 10% and overhead charges @ 5%.

12.6 Oil Bound Washable Distemper Work

12.6.1 Scaffolding

Whenever scaffolding is necessary, it shall be erected in such a way that as far as possible no part of scaffolding shall rest against the surface to be white or colour washed. A properly secured and well tied suspended platform (JHOOLA) may be used for white washing and colour washing/distempering. Where ladders are used, pieces of old gunny bags shall be tied at top and bottom to prevent scratches to the walls and floors. For white washing or colour washing/distempering of ceiling, proper stage scaffolding shall be erected, where necessary.

12.6.2 Preparation of surfaces

Specification as given below shall be applicable except that any unevenness shall be made good by applying putty, made of Plaster of Paris mixed with water on the entire surface including filling up the undulation and then sand papering the same after it is dry:
(a) Undecorated surfaces: The surfaces shall be thoroughly brushed free from dust, dirt, grease, mortar droppings and other foreign matter and sand-papered smooth. New plaster surface shall be allowed to dry for at least 2 months, before applying distemper.

(b) Decorated surfaces: All loose pieces and scales shall be removed by sand-papering and surface shall be cleaned of all grease, dust, etc. Where heavy scaling has taken place, the entire surface shall be scraped by means of steel scrapers so as to remove all accumulated distemper leaving clean surface.

(c) General: All necessary nails shall be removed. Pitting in plaster shall be made good with Plaster of Paris mixed with dry distemper of colour to be used. The surface shall then rubbed down again with a fine grade sand-paper and made smooth. A coat of the distemper shall be applied over the patches. The surfaces shall be allowed to dry thoroughly before the regular coat of distemper is allowed.

(d) The surface affected by efflorescence, moulds, moss, fungi, algae, lichen etc. shall be treated in accordance with IS: 2395 (Part 1)-1994 before applying white wash or colour wash/distemper which is briefly explained hereunder. Local areas affected by efflorescence shall be cut out and re-plastered. In case the area is not to be cut and re-plastered, then the treatment with metal foil to prevent the absorption of water from exterior or the penetration of water into the interior shall be done as under:

The area to be treated shall be cleaned of dust and allowed to dry prior to the application by means of a thin coat of bitumen primer conforming IS: 3384-1986 (Specification of bitumen primer for use in water proofing and damp-proofing). Brown type bitumen (Penetration 10 to 20) conforming to IS: 702-1988 (Specification for industrial bitumen, revised), shall be hot applied by brush at a temperature of 115°C to the surface at the rate of approximately 1.5 kg/m².

The following remedial measures shall however be adopted for the prevention of efflorescence:

Sealing coats may not effectively hold back strong efflorescence. Dry brushing of the growth as it appears is the only remedy. Efflorescent salts shall not be removed by washing with water as it may carry some of the salts back into the pores. On re-drying, efflorescence may be even worse than before if the salts were still present in the structure. Efflorescence will continue as long as there is sufficient water in the structure or plaster backings to carry the soluble salts forward and it is unless to attempt to seal the moisture by the paint film on the
surface. The treatment of an old wall with hydrofuge silicone will frequently stop the efflorescence as the liquid blocks the passage for movement of moisture. In the case of efflorescence due to the rising of salt solutions through capillary action from sub-soil the only remedy is to provide bitumen or metallic seals in the walls above the ground level so that an effective barrier to the capillary action is created.

The growths of vegetation such as Moulds, Fungi, Algae, Lichens etc., shall be removed and ammonia Cal copper solution applied to the surface. A recommended composition and concentration of the ammonia Cal wash shall consist of 7 g of copper carbonate dissolved in 80 ml liqueur ammonia and diluted to one litre with water. Alternatively, 2.5 percent magnesium silicofluoride solution may be used.

This shall be allowed to dry thoroughly before painting. To prevent recurrence of mould growth on repainted surfaces the following procedure shall be adopted:

a) Remove the source of dampness and dry out the walls;
b) Improve ventilation, if necessary;
c) Remove the infected paint or paper; and
d) Sterilize the surface by applying an antiseptic wash, such as 2 percent sodium pentachlorophenate or any other proprietary material and allow to dry.

In case of decorated surfaces already dry distempered and required for applying oil bound distempers, the distemper whether in good or bad condition shall be removed completely by washing even to the last trace and allowed to dry completely and then sand prepared smooth as per Clause 12.6.2(c) above.

12.6.3 Primer coat

The primer where used as on undecorated surfaces shall be alkali resistance primer or distemper primer as specified in the item. These shall be of the same manufacturer as oil bound distemper. 0.81 litre of distemper primer shall be used for an area of 10 sqm for each coat.

If the wall surface plaster has not dried completely, alkali resistance primer shall be applied before distempering the walls. But if the distempering is done after the wall is dried completely, distemper primer shall be applied.

Primer shall be applied with a brush on the clean dry and smooth surface. Horizontal strokes shall be given first and vertical strokes shall be applied immediately afterwards. This entire operation will constitute one coat. The surface shall be finished as uniformly as possible leaving no brush marks. It shall be allowed to dry.
for at least 48 hours before, oil bound distemper or paint is applied. However, oil bound distemper is not recommended to be applied within six months of the completion of wall plaster. For decorated surfaces, no primer is necessary.

12.6.4 Preparation of oil bound distemper

The distemper shall be diluted with water or any other prescribed thinner in a manner recommended by the manufacturer. Only sufficient quantity of distemper required for day’s work shall be prepared. 0.81 litre of distemper shall be used for area of 10 sqm.

For undecorated surfaces 1.5 kg of distemper shall be used for two coats for an area of 10 sqm. For decorated surfaces, 1 kg of distemper shall be used for one coat for an area of 10 sqm. For every additional coat, 1 kg of distemper shall be used for an area of 10 sqm.

12.6.5 Application of distemper coat

For undecorated surfaces, after primer coat has dried for at least 48 hours, the surface shall be lightly sand-papered to make it smooth receiving the distemper, taking care not to rub out the priming coat. All loose particles shall be dusted off after rubbing. Minimum two coats of distemper shall be applied with brushes in horizontal strokes followed to immediately by vertical which together shall constitute one coat. The subsequent coats shall be applied after a time interval of at least 24 hours between consecutive coats to permit of the proper drying of the preceding coat. For decorated surfaces, the distemper shall be applied in one coat or more over the prepared surface in the same manner as for undecorated surfaces.

The finished surface shall be even and uniform without patches, brush marks, distemper drops etc.

Sufficient quantity of distemper shall be mixed to finish one room at a time. The application of a coat in each room shall be finished in one operation and no work shall be started in any room, which cannot be completed the same day.

15 cm double bristled distemper brushes shall be used. After each day’s work, brushes shall be thoroughly washed in hot water with soap solution and hung down to dry. Old brushes which are dirty and cracked with distemper shall not be used on the work.

12.6.6 Protective measures

Surface of doors, windows, floors, articles of furniture, etc. and such other parts of the building not to be white washed or colour washed/distempered shall be
protected from being splashed upon such surfaces. It shall be cleaned of whitewash or colour wash/distemper splashed, if any by the Contractor at his own cost.

12.6.7 Measurements

The measurements shall be done as below.

12.6.7.1 Priming and alkali resistant treatments, scraping of surfaces, washing the surfaces spoiled by smoke soot, removal of oil and grease spots, treatment for infection with efflorescence, moulds, moss, fungi, algae and lichen, and patch repairs to plaster above 0.10 sqm wherever done, shall be measured separately.

12.6.7.2 Work on walls, ceilings, and/or sloping roofs shall each be measured separately.

12.6.7.3 Work on decorated surfaces shall be measured separately.

12.6.7.4 All work shall be measured net in the decimal system as in places, subject to the following limits unless otherwise stated hereinafter.

(a) Dimensions shall be measured to the nearest 0.01 m.

(b) Areas in individual items shall be worked out to the nearest 0.01 sqm.

12.6.7.5 All work unless and otherwise stated shall be measured in square meters.

12.6.7.6 Deductions

For jambs, soffits, sills, etc.: For openings not exceeding 0.5 sqm each in area; for ends of joints, beams, posts, girders, etc. not exceeding 0.5 sqm in area and for opening exceeding 0.5 sqm and not exceeding 3 sqm each in area. Deductions and additions shall be made in the following manner:

No deductions shall be made for ends of joists, beams, posts, etc., and openings not exceeding 0.5 sqm each and no addition shall be made for reveals, jambs, soffits, sills etc. of these openings nor for finish around ends of joists, beams, posts etc. Deductions for openings exceeding 0.5 sqm but not exceeding 3 sqm each, shall be made as follows and no addition shall be made for reveals, jambs, soffits etc. of these openings.

(a) When both the faces of the wall are provided with the same finish, deduction shall be made for one face only.

(b) When each face of wall is provided with a different finish, deduction be made for that side of frame for door, window etc. on which width of reveal is less than that of the other side but no deduction shall be made on the other sides; where widths of reveals on both faces of wall are equal, deduction of 50% of opening on each face shall be made from area of finish.

(c) When only one face of the wall is treated and the other face is not treated, full deduction shall be made if the width of the reveal on the treated side is less than
that on the untreated side, but if the width of the reveal is equal or more than that on the untreated side, neither deductions nor addition be made for reveals jambs, soffits, sill, etc.

12.6.7.7 In case of openings of areas exceeding 3 sqm each deduction shall be made for openings, but jambs, soffits and sills shall be measured.

12.6.7.8 No deductions shall be made for attachment such as casings, conduits, pipes, electric wiring and the like.

12.6.7.9 Corrugated surfaces shall be measured flat as fixed and not girthed. The quantities so measured shall be increased by the following percentages and the resultant shall be included with the general areas.

| (a) Corrugated steel sheets | 14% |
| (b) Corrugated asbestos cement sheets | 20% |
| (c) Semi-corrugated asbestos cement sheets | 10% |
| (d) Nainital pattern roofs (Plain sheeting with rolls) | 10% |
| (e) Nainital pattern roofs with corrugated sheets | 25% |

12.6.7.10 Cornices and other wall features, when they are not picked out in a different finish/colour, shall be girthed and included in the general area.

All items shall include removing nails, making good holes, cracks, patches etc. not exceeding 0.1 sqm each with material similar in composition to the surface to be prepared.

12.6.8 Rate

The labour rate includes the cost of all materials and labour required for completing the work as per specifications.

1. The labor rates and through rates include carriage up to 100 metres on head load and one kilometer by mechanical transport.

2. The labour rates include the sundry items like sand, papers scrappers, soap and soda etc. as also the water charge.

3. The labour rates also include the labour required for thoroughly mixing the mortar and all sorts of scaffolding and ladders etc.

4. The specialty paints shall be the paints which are declared as such by Chief Engineer, Uttarakhand Pradesh Public Works Department. All items shall be paid as per latest applicable Vikas NagarDSR schedule of rates. The rate also includes contractor’s profit @ 10% and overhead charges @ 5%.
13. FITTINGS FOR DOORS

13.1 General

Fitting shall be of iron, brass, aluminium or as specified. These shall be well made, reasonably smooth, and free from sharp and corners, flaws and other defects. Screw holes shall be counter sunk to suit the head of specified wood screws. These shall be of the following type according to the material used.

(a) Iron Fittings: These shall be black enamelled or copper oxidised (black finish) or as specified.

(b) Brass Fittings: These shall be finished bright chromium plated or oxidised or as specified.

(c) Aluminium Fittings: These shall be anodised.

The fittings generally used for different type of doors and windows are indicated in the table. The fittings to be actually provided in a particulars work shall however be determined by the Engineer.

Screws used for fittings shall be of the same metal, and finished as the fittings. However, Chromium plated brass screws shall be used for fixing aluminium fittings. These shall be of the size as indicated in respective figures.

Fittings shall be fixed in proper position as shown in the drawings or as directed by the Engineer. These shall be truly vertical or horizontal as the case may be. Screws shall be driven home with screw driver and not hammered in, Recesses shall be cut to the exact size and depth for the countersinking or hinges.

13.1.1 Butt Hinges

These shall be of the following types according to the material used, and as specified:

(a) Mild Steel butt hinges (Medium)

(b) Cast brass butt hinges light/ordinary or heavy.

(c) Extruded aluminium alloy butt hinges.

13.1.1.1 Mild steel butt hinges (medium) [refer Fig. 23]

13.1.1.1.1 These shall be medium type manufactured from M.S. sheet. These shall be well made and shall be free from flaws and defects of all kinds. All hinges shall be cut clean, and square and all sharp edges and corners shall be removed. These shall conform to IS: 1341-1992.
Hinge pin shall be made of mild steel wire. It shall fit inside the knuckles firmly and rivetted head shall be well formed so as not to allow any play or shake, and shall allow easy movement of the hinge, but shall not cause looseness.

**Knuckles:**

The number of knuckles in the hinges of different sizes shall be as indicated in Fig. 23. The size of knuckles shall be straight and at right angle to the flap. The movement of the hinges shall be free and easy and working shall not have any play or shake.

**Screw holes:**

The screw holes shall be clean and counter sunk. These shall be suitable for counter sunk head wood screws and of the specified size for different types and sizes of hinges. The size of the holes shall be such that when it is counter sunk it shall be able to accommodate the full depth of counter sunk head of the wood screws.

13.1.1.1.2 Sampling and Criteria for Conformity

The number of butt hinges to be selected from a lot shall depend on the size of lot and shall be in accordance with table below.

Butt hinges for testing shall be taken at random from at least 10 percent of the package subject to a minimum of three equal number of hinges being selected from each package. All butt hinges selected from the lot shall be checked for dimensional and tolerance requirements. Defects in manufacture and finish shall also be checked. A lot shall be considered conforming to the requirements of this specification, if the number of defective hinges along those tested does not exceed the corresponding number given in table below.

<table>
<thead>
<tr>
<th>Lot size</th>
<th>Sample size</th>
<th>Permissible No. of defective hinges</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 200</td>
<td>15</td>
<td>0</td>
</tr>
<tr>
<td>201 to 300</td>
<td>20</td>
<td>1</td>
</tr>
<tr>
<td>301 to 500</td>
<td>30</td>
<td>2</td>
</tr>
<tr>
<td>501 to 800</td>
<td>40</td>
<td>2</td>
</tr>
<tr>
<td>801 and above</td>
<td>55</td>
<td>3</td>
</tr>
</tbody>
</table>

Note: Any hinge which fails to satisfy the requirements of any one or more of the characteristics shall be considered as defective hinge.

13.1.2 Door Bolts

13.1.2.1 Sliding Door Bolts (Aldrops) [refer Fig. 24]
13.1.2.1.1 These shall be of mind steel, cast brass, aluminum or as specified, and shall be capable of smooth sliding action.

13.1.2.1.2 M.S. Sliding Door Bolts
These shall be made of M.S. sheets and M.S. rods and shall conform to IS: 281-2009. M.S. Sliding door bolts shall be copper oxidised (black finish) or as specified.

13.1.2.1.3 Cast Brass Sliding Door Bolts
These shall be made from rolled brass, and shall conform to IS: 2681-1993. The hasp shall be of cast brass and secured to the bolt as shown in Fig. 24. Alternatively, the hasps and the bolt may be cast in one piece. The fixing and staple bolts shall be cast with 6 mm studs bolts shall be finished to shape and have thread ends and provided with round wormers and nuts of square or hexagon type. All components shall be finished smooth and polished before assembly. Cast brass sliding bolts shall be finished bright or chromium plated or oxidised or as specified.

13.1.2.1.4 Aluminium Sliding Door Bolts
These shall be made of aluminum alloy, and shall conform to IS: 2681-1993. Aluminum sliding door bolts shall be anodised. All screw holes shall be counter sunk to suit the counter sunk head of wood screws of specified sizes. All edges and corners shall be finished smooth. In case of single leaf door, when iron socket plate or a brass or aluminum fixing bolts (or slinging door bolts) cannot be fixed, hole of suitable size shall be drilled in the door frame and an iron or brass plate cut to shape shall be fixed at the face of the hole. The leading dimensions of the sliding door bolts are illustrated in Fig. 24.

13.1.2.1.5 Sampling and Criteria for Conformity
It shall be same as specified in section 13.1.1.1.2 above.

13.1.2.2 Tower Bolts (refer Fig. 25)

13.1.2.2.1 Tower bolts shall be well made and shall be free from defects. The bolts shall be finished to the correct shape and shall have a smooth action. All tower bolts made with sheets 1.2 mm thickness and above shall have counter sunk screw holes to suit counter sunk head wood screws. All sharp edges and corners shall be removed and finished smooth.

The height of top of tower bolt when the door window etc. is in closed position from the floor level shall be 1.90 meters.

13.1.2.2.2 Tower bolts shall be of the following types:
(a) Aluminium barrel tower bolts with barrel and bolt of extruded sections of aluminium alloy. The knob shall be properly screwed to the bolt and riveted at the back.

(b) Brass tower bolts with cast brass barrel and rolled or cast brass bolt

or

Brass tower bolts with barrel of extruded sections of brass and rolled or drawn brass bolt.

The knobs of brass tower bolts shall be cast and the bolt fixed with knob, steel spring and ball shall be provided between the bolt and the barrel.

(c) Mild steel barrel tower bolts with mild steel barrel and mild steel bolt.

or

Mild steel tower bolts with mild steel barrel and cast iron bolts. The plates and straps after assembly shall be firmly riveted or spot welded. The rivet head shall be properly formed and the rivet back shall be flush with the plate. These shall be made of one piece.

13.1.2.2.3 Unless otherwise specified bolt shall have finish as given under:

(a) Mild steel tower bolts (types 1 and 2). Bolts bright finished or plated as specified and barrel socket stove enameled black.

(b) Brass tower bolts (types 3 to 5) bolts and barrel polished or plated as specified.

(c) Aluminium alloy tower bolts (type 6) bolts and barrel anodised. The anodic film may be either transparent or dyed as specified. The quality of anodised finished shall not be less than grade AC 10 of IS: 1868-1996.

13.1.2.2.4 Sampling and Criteria for Conformity

It shall be same as specified in section 13.1.1.1.2 above.

13.1.3 Door Handles (refer Fig. 26)

13.1.3.1 The door handles be well made free from defects. These shall be finished correct to shape and dimensions. All edges and corners shall be removed and finished smooth so as to facilitate easy handling. Cast handles shall be free from casting defects. Where the grip portion of the handle is joined with the piece by mechanical means, the arrangements shall be such that the assembled handle shall have adequate strength comparable to that of integrally cast type handles.

13.1.3.2 Door handles shall be of the following types according to the material used.

(a) Cast Aluminium Handles
These shall be of aluminium of specified size, and of shape and pattern as approved by the Engineer. The size of the handle shall be determined by the inside grip of the handle. Door handles shall be of 100 mm size, and window handles of 75 mm unless otherwise specified. These shall be fixed with 25 mm long wood screws of designation No. 6. Aluminium handles, shall be anodized and the anodic consisting shall not be less than grade AC 15 of IS: 1868-1996 or as specified.

(b) Cast Brass Handles

These shall be cast brass of specified size and the shape and pattern as approved by the Engineer. These shall conform to IS: 208-1996. The size of the handle shall be determined by the inside grip of the handle. Door handles shall be of 100 mm size and window handles of 75 mm size unless otherwise specified. These shall be fixed with 25 mm long wood screws of designation No. 6. Brass handles shall be finished bright or chromium plated or oxidised or as specified.

(c) Mild Steel Handles

These shall be of mild steel sheet, pressed into oval section. These shall conform to Indian Standard specifications for door handles IS: 208-1996. The size of the handles will be determined by the inside grip of the handle. Door handles shall be of 100 mm size and window handles of 75 mm size unless otherwise specified. These shall be fixed with 25 mm long wood screws of designation No. 6. Iron handles shall be copper oxidised (black finish) or as specified.

13.1.3.3 Sampling and Criteria for Conformity

It shall be same as specified in section 13.1.1.1.2 above.

13.1.4 Floor Door Stopper (refer Fig. 27)

This shall be made of cast brass of overall size as specified and shall have a rubber cushion. The shape and pattern of stopper shall be approved by the Engineer. It shall be of brass finished bright, chromium plated or oxidised or as specified. The size of floor stopper shall be determined by the length of its place. It shall be well made and shall have four counter sunk holes for fixing the door stoppers to the floor by means of wood screws. The body or housing of the door stopper shall be cast in one piece and it shall be fixed to the cover plate by means of brass or mild steel screws and cover plates shall be of casting or of sheet metal. The spring shall be fixed firmly to the pin. Tongue which would be pressed while closing or opening of
the door shall be connected to the lower part by means of copper pin. On the extreme end a rubber piece shall be attached to absorb shocks. All parts of the door stopper shall be of good workmanship and finish, burrs and sharp edges removed. It shall be free from surface and casting defects. Aluminium stopper shall be anodized and anodic film shall not be less than grade AC 10 of IS: 1868-1996. The rubber for the floor door stopper shall meet the following requirements.

### Requirements for Rubber

<table>
<thead>
<tr>
<th>Particulars</th>
<th>Requirements</th>
<th>Testing Procedure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relative density (Max.)</td>
<td>1.3</td>
<td>IS: 3400 (Part 9)-2004</td>
</tr>
<tr>
<td>Hardness</td>
<td>60 ± 5</td>
<td>IS: 3400 (Part 2)-2004</td>
</tr>
<tr>
<td>Change in initial hardness ageing for 24 hours at 100°C± 1°C</td>
<td>± 5</td>
<td>IS: 3400 (Part 2)-2004</td>
</tr>
</tbody>
</table>

These shall be of cast brass, finished bright, chromium plated or as specified. Aluminium stopper shall be anodized and the anodic coating shall not be less than grade AC 10 of IS: 1868-1996. The size and pattern of the door stopper shall be approved by the Engineer. The size shall be determined by its length.

**Sampling and Criteria for Conformity:**

It shall be same as specified in section 13.1.1.1.2 above.

### 13.2 Fittings

All fittings are subject to the approval of the Executive Engineer and where so directed by him, the Contractor must deposit in his office one sample of each fitting to be used in the work. Brass and other special fittings shall ordinarily be arranged departmentally and issued to the Contractor for fixing, or as specified. The fittings shall be provided as per Schedules given below. The fitting shall conform to the specifications laid down in section 13.1 above.

### 13.3 Screws

Screws shall be used of such diameter as to fill completely the holes and cups in the fitting which they secure, and are to be oiled before being inserted. Unless the head can be counter-sunk flush with the fitting, round-headed screws shall be used. Brass fitting shall be secured with brass screws.

1. Door of room adjoining the verandah corridor, lobby or hall shall be considered as external door.
2. Where the height of door leaf exceeds 2.15 meters above floor level one extra hinge shall be provided for every additional height or 0.5 metre or part thereof and the length of top door bolts shall be increased by the height of the leaf above 2.15 meters from floor level.

3. Single leaf door shutters of more than 80 cm width shall be provided with one extra hinge.

4. Where the height of window shutters exceeds 1.20 metres one extra hinge shall be provided, and the length of top door bolts shall be increased by the height of the leaf above 2.15 meters from the floor level.

5. Fan-light shutters of more than 0.80 m width shall be provided with one extra hinge.

6. In double leaf shutters of doors and window, two door bolts shall be fixed to the first shutter and one to the closing shutter at the top in case of windows, windows with double shutters, two bolts shall be fixed to closing shutter and one to the first shutter at top.

7. For centrally hung and bottom hung C.S. windows and fan lights a bamboo pole with hook for opening ventilators shall be provided for each residence or set of 4 rooms in case of office building.

8. In case of single leaf inter-communicating door shutter from bath and W.C. to a bedroom, one 250 mm one 150 mm tower bolts shall be replaced with one door latch 250 mm size.

9. For shutter exceeding 40 mm thickness heavy type M.S. Butt hinges of 125 x 90 x 4mm shall be used.

10. Window shutters with steel frames shall be provided with six hinges in case of double leaf shutters and three hinges in case of single leaf shutters, irrespective of height and width of shutters.

13.4 Frame Fixing in Position and Hold-fasts

13.5 The frames shall be fixed only after acceptance by the Engineer. The method of fixing as indicated in the drawing or otherwise directed by the Engineer shall be followed. In case of door frames without sills, the vertical members shall be buried in floor for the full thickness of the floor.

Where doors are not provided with sills, the door frame shall be temporarily braced at the sill level so as to prevent warping or distortion of frame during construction. Frames shall also be suitably protected from damage during construction.

Chowkhats shall be secured to the brick work or masonry by hold-fasts which shall be build into the wall with 1:4 cement sand mortar. Each hold-fast shall be fixed to the chowkhats with three 5 cms iron screws. Where the chowkhat is fixed at the extreme edges of the jambs, the hold-fasts shall be forked or bent as directed by the Engineer. The number of hold-fasts to each chowkhat shall be as indicated in the figure/drawing.
Hold-fasts used for fixing doors and windows frame shall be made of 40 x 3mm flat iron and 40 cm long. It shall have a hole on one end for fixing to frame with 10 mm dia bolt, at the other end. The flat iron shall be split and bent at right angles in the opposite direction. The hold-fast shall be tightly fixed to the frame by means of bolts, the bolt hole in frame being plugged suitably and finished neat. The hold fast shall be embedded into masonry by concrete block as described in the item of work.

13.6 Measurements

13.6.1 Hold-fasts

Hold fasts shall be counted in numbers and paid accordingly.

13.6.2 Fittings

Fittings shall be counted in numbers as specified in drawing.

13.6.3 General

The rate includes all the material and labour required for completing the work as per specification mentioned above and as specified for each item in the latest applicable. The through rates as applicable in DSR of Uttarakhand include carriage up to 1 km by mechanical transport and head load upto 100 metres. The contractor’s profit @ 10% and overhead charges @ 5% are including the rates. The labour rate includes the cost of tools and scaffolding whenever required.

13.6.4 Fittings

The rates shall be as specified in 13.6.1 above.

14. PAINTING WORK

14.1 Materials

All materials used shall conform to the specifications given below:

14.1.1 Painting Brushes

The brushes used for painting work shall conform to the following Indian standards:

<table>
<thead>
<tr>
<th>I.S. No.</th>
<th>Subject</th>
</tr>
</thead>
<tbody>
<tr>
<td>384-2002</td>
<td>Brushes, Paints and Varnishes, Flat – Specification</td>
</tr>
<tr>
<td>486-1983</td>
<td>Specification for Brushes, Sash Tool, for Paints and Varnishes</td>
</tr>
<tr>
<td>487-1997</td>
<td>Brushes, Paint and Varnish - (i) Oval, Ferrule Bound; and (ii) Round, Ferrule Bound</td>
</tr>
</tbody>
</table>

The flat brushes for paints and varnishes shall be of the following sizes: 12 mm, 25 mm, 38 mm, 50 mm, 63 mm, 75mm and 100 mm.

Refer section 14.2.2.9 below for supporting work specifications for brushes.
14.1.2 Oils, Paints and Primers etc.

Oils, paints, primers etc. shall be used of approved brand and manufacture, as directed by the Engineer. The relevant specifications are given below. For details of other painting materials and specifications, provisions in section 2.23 of Chapter 2, UKPWD Specifications (Vol. I), 1990 shall be followed.

14.1.2.1 Oils

14.1.2.1.1 Linseed Oil (Raw)

Linseed oil shall be as per IS: 75-1973. Raw linseed oil shall be lightly viscous but clear and of yellowish colour with light brown tinge. Its gravity at a temperature of 30° C shall be between 0.923 and 0.928. The oil shall be mellow and sweet to the taste with very little smell. The oil shall be of sufficiently matured quality. Oil, turbid or thick, with acid and bitter taste and rancid colour and which remains sticky for a considerable time shall be rejected. The oil shall conform in all respects to IS: 75-1973. The oil shall be of approved brand and manufacture.

14.1.2.1.2 Linseed Oil (Double boiled)

Linseed oil (double boiled) shall be as per IS: 77-1976. This covers two types namely type I boiled and type II Pale boiled. The material is used in paint industry and in other allied applications, and also as foundry core oil.

14.1.2.1.3 Turpentine Oil

Turpentine oil shall conform to IS: 533-2007. It is generally used as a solvent for paints and pigments.

14.1.2.2 Paints

14.1.2.2.1 General

Paint is a mixture of solids and liquids and is used to cover surfaces for decorative and preservative purposes. The solids are the pigments or base, and the liquids the medium or vehicle to enable the solid particles to be applied to the surface. The functions of the solids are to provide body or substance, to give colour and obscuring power to the film of paint, and to protect it from too rapid decomposition. The functions of the liquids are to hold the solid particles in suspension and to allow the materials to be spread evenly over a surface. They also help to bind the particles together and to give cohesion and gloss to the painted surface. Coloured pigments provide the requisite tints to the paint, and are often known as strainers. They may be natural earth pigments, such as iron oxides or chemically manufactured colours, such as chrome yellow and Prussian blue. These pigments are sometimes used in
combination with a white pigment called the base, which gives the main bulk and weathering properties to the paint.

14.1.2.2 Enamel Paint (White)

Enamel paint (conforming to IS: 2933-1975) of approved brand and manufacture and of the required colour shall be used. For the end coat the paint of same quality but of shade to suit the top coat shall be used.

14.1.2.2.3 Synthetic Enamel in all Shades except White

Synthetic Enamel paint (conforming to IS: 2932-2003) of approved brand and manufacture and of the required colour shall be used for the top coat and an undercoat of shade to match the top coat as recommended by the manufacturer shall be used.

14.1.2.4 Red Lead Paint

This shall be conforming to IS: 57-1989.

14.1.2.3 Pigment

Pigments shall be of non-organic origin and of approved manufacture and suitable for mixing with cement. Aniline base colour or other organic dyes shall not be used as they are likely to fade. The use or pigments shall be resorted to only when ready-made Portland cement inspired colour is not available. The Contractor shall use coloured Portland cement in lieu of mixing cement with pigments without extra cost. General guide to the selection of mineral pigments to obtain various colour effects is given below:

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Colour desired</th>
<th>Commercial names of colours for use with cement</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Grey, black</td>
<td>Black iron oxide, manganese black</td>
</tr>
<tr>
<td>2</td>
<td>Brownish red to dull brick red</td>
<td>Red oxide of iron</td>
</tr>
<tr>
<td>3</td>
<td>Bright red to vermillion</td>
<td>Mineral turkey red</td>
</tr>
<tr>
<td>4</td>
<td>Red sandstone to purplish red</td>
<td>Indian red</td>
</tr>
<tr>
<td>5</td>
<td>Brown to reddish brown</td>
<td>Metallic brown (oxide)</td>
</tr>
<tr>
<td>6</td>
<td>Buff colonial tin and yellow</td>
<td>Yellow ochre yellow oxide of iron</td>
</tr>
<tr>
<td>7</td>
<td>Green</td>
<td>Chromium oxide</td>
</tr>
<tr>
<td>8</td>
<td>Blue</td>
<td>Ultramarine blue</td>
</tr>
</tbody>
</table>
14.1.2.4 Primers

14.1.2.4.1 Cement Primer

Cement primer coat is used as a base coat on wall finish of cement, lime or lime cement plaster or on asbestos cement surfaces before oil emulsion distemper paints are applied at them. Cement primer is composed of a medium and pigment which are resistant to the alkalis present in the cement, lime or lime cement in wall finish and provides a barrier for the protection of subsequent coats of oil emulsion distemper paints. It shall be applied by brushing and not by spraying. The primer shall be avoided particularly on absorbent surfaces.

14.1.2.4.2 Metal Primer

Metal primer is used in painting system mainly followed for metal surfaces for the protection of steel works both under marine and inland out-doors conditions.

14.1.2.4.3 Primer for Expansion Joints

Primer for expansion joints shall be of best quality and subject to the approval of the Engineer.

14.1.2.4.4 Zinc Oxide Chrome / Red Oxide / Red Lead Primer

It shall conform to relevant I.S. Specifications. It is used on aluminum and steel and galvanised steel work.

14.1.2.4.5 Miscellaneous

14.1.2.4.5.1 Putty for Steel Work

This shall be of approved brand and manufacture and shall conform to relevant I.S. Specifications.

14.1.2.4.5.2 Plaster of Paris

This is a white power material used for finishing works not liable to heavy load. This shall conform to IS: 2333-1992. The material is often used for decoration purposes.

14.1.2.4.5.3 Mordant Solution

This shall be composed of:

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soft water</td>
<td>64 parts</td>
</tr>
<tr>
<td>Copper chloride</td>
<td>1 part</td>
</tr>
<tr>
<td>Copper nitrate</td>
<td>1 part by weight</td>
</tr>
<tr>
<td>Ammonium Chloride</td>
<td>1 part</td>
</tr>
</tbody>
</table>
14.1.2.4.5.4 Coal Tar Paint

Coal tar paint of approved brand and manufacture shall be used. It shall conform to IS: 290-1961. The specifications cover two types, namely, Type-A quick drying and Type-B slow drying. The material is generally used as a protective paint for iron, steel and timber.

14.1.2.4.5.5 Kerosene Oil

This shall conform to IS: 1459-1974. Kerosene oil is used as solvent for paints and pigments.

14.1.2.4.5.6 Spirit

This shall conform to IS: 324:1959 specifications for ordinary denatured spirit. It is generally used as a solvent and vehicle in paint industry, and as fuel also.

14.1.2.4.5.7 Shellac

This shall conform to IS: 16-2008.

14.1.2.4.5.8 Creosote Oil

It shall confirm to IS: 218-1983. This is used as general purpose wood preservatives and mainly in the treatment of railway sleepers, telegraph and telephone poles.

14.1.2.4.5.9 Bees Wax

This is used as a polish.

14.1.2.4.5.10 Patent knotting

This is a liquid product used on wood work over knots. This shall be of approved brand and manufacture.

14.2 General Workmanship

14.2.1 General

14.2.1.1 Painting shall not be started until the Engineer has inspected the items of work to be painted, satisfied himself about their proper quality and given his approval to commence the painting work.

14.2.1.2 The materials for the execution of painting work shall be obtained direct from approved manufacturers and brought to the site in maker's drums, kegs, etc. with seals unbroken. All paints shall not be inferior to relevant Indian Standards as mentioned in specifications.

14.2.1.3 All materials not in actual use shall be kept properly protected. Lids of containers shall be kept closed and surface of paint in open or partially open containers is
covered with a thin layer of turpentine to prevent formation of skin. Materials which have become stale or fat due to improper and long storage shall not be used. The paint shall be stirred thoroughly in its container before pouring into small containers. While applying also the paint shall be continuously stirred in the smaller container. No left over paint shall be put back into stock tins. When not in use, the containers shall be kept properly closed.

14.2.1.4 If for any reason, thinning is necessary, in case of ready mixed paint, the brand of thinner recommended by manufacturer shall be used.

14.2.1.5 Painting except the priming coat shall generally be taken in hand after all other builder’s work is practically finished. The rooms shall be thoroughly swept out and the entire building cleaned up at least one day in advance of the paint work being started.

14.2.1.6 The surface to be painted shall be thoroughly cleaned and dusted. All rust, dirt, scales, smoke and grease shall be thoroughly removed before painting is started. No painting on exterior or other exposed parts of the work shall be carried out in wet, humid or otherwise unfavourable weather and all the surfaces must be thoroughly dry before painting work is started.

14.2.1.7 Brushes used for painting shall comply with the Indian Standard Specifications. The brushes used shall be of the approved type and of a size suitable for the work in hand. For general wood work, including doors, sashes etc., a (7.5 to 10 cm) brush for larger areas and a (5 cm) for the rails would be considered suitable. Alternatively, ground brush and No. 1 sash tool respectively are sometimes preferred. For flat wall paint, flat brushes from (10 to 15 cm) width are also used.

14.2.1.8 Brushes shall be rubbed out at the close of the work and kept immersed in a mixture of linseed oil and white spirit, when not in use. Before being used again, the oil and spirit must be rubbed out. If not required, for some time or when required to be used with another colour, the brushes shall be cleaned out with turpentine and then washed with soapy water. A brush in which paint has dried, is ruined and shall on no account be used. Now brushes may contain dressing of extraneous matter and shall be well washed with soapy water before use.

14.2.1.9 Only skilled painters shall be employed for paint work, and the labourers required to help shall not exceed the number of the skilled workmen.

14.2.1.10 Each coat of paint shall differ slightly in tint from the preceding one, so as to make each coat readily distinguishable. The last coat being of the tint required for the
finished work. Every coat shall be perfectly dried and shall be got approved from the Assistant Engineer before applying.

14.2.1.11 The main requirement of priming coat is that it should adhere firmly to the unpainted surface and also provide a suitable ground to receive and hold the next coat. It is most important that the priming paint should be of the correct type for the surface to be painted and that it should be supplied in a proper manner. Special care shall be paid to places where decay or corrosion is likely to occur, such as joints in wood or metal and end grain in wood. Hurried priming should be avoided particularly on absorbent surfaces. Any primed work that has been allowed to deteriorate through exposure for a long period; it must be removed with pumice stone or other suitable abrasive. The priming coat shall be applied again.

14.2.1.12 Stepping and filling shall be done after priming. The material required for this purpose shall conform to Indian Standards specifications. Stepping is used to fill holes and cracks, while the function of the filler is to level up slight irregularities of surface. Filler shall be applied with a break knife and shall be subsequently rubbed down to a level surface with abrasive paper, pumice stone or other suitable abrasive.

14.2.1.13 The functions of the paint used for undercoating are to obscure the primed surface, to provide a fresh surface of uniform texture and of a colour approaching that of a finishing coat, and to build up a layer of paint sufficient in type and thickness to protect the material painted according to the conditions of exposure.

The number of undercoats required in each case will depend upon the type of finish desired and on the conditions of exposure. For most works, a minimum of one undercoat is needed while for works requiring a high class gloss finish of required to undergo a severe exposure, a large number of undercoats may be needed.

14.2.1.14 The finishing coat in a paint system is intended to provide the particular colour and degree of texture required. In external work, the finishing coat also serves to protect the main body of the paint beneath and it should therefore, be renewed when necessary before undercoat becomes seriously damaged by the weather.

14.2.1.15 Care shall be taken while painting to avoid damage to furniture, floors etc., and to maintain general tidiness. The Contractor shall remove with turpentine or any other approved method all stains, smears, splashing and dropping of every kind from floors glazing, furniture and from similar situations.

14.2.1.16 Since some of the paints are poisonous, painters should never fail to wash their hands after painting. Precautions may also be taken that workmen do not smear
themselves with paints unavoidably. Where it is necessary to rub down with sand paper, only water proof paper shall be used and the work kept wet. Too much pressure not be used in rubbing. Slush formed in rubbing must be frequently washed off with plenty of water.

14.2.2 Application of paints

14.2.2.1 Brushing of paints

The brushing operations are to be adjusted to the spreading capacity advised by the manufacturer of the particular paint. The painting shall be applied evenly and smoothly by means of crossing and laying off, the later in the direction of the grain of wood. The crossing and laying off consists of covering the area over with paint, brushing the surface hard for the first time over and then brushing alternately in opposite directions two or three times and then finally brushing lightly in a direction at right angles to the same. In this process, no brush marks shall be left after the laying off is finished. The full process of crossing and laying off will constitute one coat.

During painting, every time after the paint has been worked out of the brush bristles or after the brush has been unleaded, the bristles of the brush which are down together due to the high surface tension of the small quantities of paint left in between the bristles, shall be opened up by striking the brush against a portion of the painted surface with the end of the bristles held at right angles to the surface. So that bristles thereafter will collect the correct amount of paint when dipped again into the pain container.

14.2.2.2 By spraying

Where so stipulated, the painting shall be done with spray. Spray machine used may be (a) high pressure (small air aperture) type, or (b) a low pressure (large air gap) type, depending on the nature and location of work to be carried out. Skilled and experienced workmen shall be employed for this class of work. Paints used shall be brought to the requisite consistency by adding a suitable thinner.

Spraying should be done only when dry condition prevails. During spraying the spray gun shall be held perpendicular to the surface to be coated and shall be passed over the surface in a uniform sweeping motion. Different air pressures and fan adjustment shall be tried so as to obtain the best application with the minimum wastage of paint. The air pressure shall not be kept too high as otherwise the paint will clog up and will be wasted.
Spots that are inaccessible to the spray pattern shall be touched up by brush after spraying.

At the end of the job, the spray guns shall be cleaned thoroughly so as to be free from dirt. Incorrect adjustments shall be set right, as otherwise they will result in variable spray patterns, runs, sags and uneven coats.

14.2.2.3 Each coat shall be allowed to dry completely and lightly rubbed with very fine grade of sand paper and loose particles brushed off before next is applied. Each coat shall very slightly in shape and shall be got approved from the Engineer before next coat is started.

14.2.2.4 Each coat except the last coat, shall be lightly rubbed down with sand paper or fine pumice stone and cleaned off dust before the next coat is applied.

14.2.2.5 No hair marks from the brush or clogging of paint puddles in the corner of panels of mouldings etc. shall be left on the work.

14.2.2.6 In painting doors and windows, the putty round the glass panes shall be taken to see that no paint stains etc., are left on the glass. Tops of shutters and surfaces in similar hidden locations shall not be left out in painting.

14.2.2.7 In painting steel work, special care shall be taken while painting over bolts, nuts, rivets, overlaps etc.

14.2.2.8 The additional specifications for primer and other coats of paints shall be as according to the detailed specifications under the respective headings.

14.2.2.9 Brushes and containers

After work, the brushes shall be completely cleaned off of paint and linseed oil by rinsing with turpentine. After cleaning, the brushes are wrapped in heavy paper or water proof paper for storage. If it is to be used the next day, it shall be hung in a thinner or linseed oil in a container. On no account, shall brushes be made to stand on the bristles. A brush in which paint has dried up is ruined and shall on no account be used for painting work. The containers when not in use, shall be kept closed and free from air so that paint does not thicken and also shall be kept guarded from dust. When the paint has been used, the containers shall be washed with turpentine and wiped dry with soft clean cloth, before they can be used again.

In addition, the containers of paints have expiry date marked by the manufacturers, which should be highlighted so as to facilitate use of paint within due period.

14.3 Concrete/Masonry/Plastered Surfaces

14.3.1 General

Reference shall be made to the following Indian Standards:
IS No. | Subject
--- | ---
2395 (Part 1)-1994 | Painting of Concrete, Masonry and Plaster Surfaces - Code of Practice: Part 1 - Operations and Workmanship
2395 (Part 2)-1994 | Painting of Concrete, Masonry and Plaster Surfaces - Code of Practice: Part 2 – Schedules

14.3.2 Preparation of surface

The surface to be painted shall be allowed to dry for at least three months. Any existing fungus or mould growth shall be completely removed. All major cracks or defects in the plaster shall be cut out and made good. Before primer is applied holes and undulations shall be filled up with Plaster of Paris and rubbed smooth.

New Surfaces: Before painting, the surface shall be thoroughly brushed to remove all dirt and remains of loose and powered material.

In case of new brick-work the surface shall be cleaned of dirt by washing with water. Any glazed area shall be roughened. Wire brushes shall be avoided in cleaning operations as these shall lead to difficulties from deposited particles of iron causing iron stains.

If before painting any portion of the wall shows sign of dampness, the causes shall be investigated and the damp surface shall be properly treated.

14.3.3 Application of primers and paints

After preparation of the surface, the priming coat shall be applied immediately. The specification of paints shall conform to para 14.1.2 and 14.2.2 above.

The primers and paints used shall be of the following type.

1. Ready mixed, priming paint/red lead/red oxide/zinc oxide chrome.
2. Enamel paint.
3. Ready-mixed paint.
4. Aluminium paint.
5. Bituminous paint (Black Anti-Corrosive).
7. Ready mixed acid resisting paint.
8. Coal tar black paint.
10. Superior Ready-mixed for G.I. sheets.
14.4 Measurements

14.4.1 All work shall be measured net in the decimal system as executed subject to the following limits, unless otherwise stated here-in-after:

(a) Dimensions shall be measured to the nearest 0.01 metre.

(b) Areas shall be worked out to the nearest 0.01 sq.mt.

14.4.2 No deduction shall be made for openings not exceeding 0.5 sqm each, and no addition shall be made for painting to beading mouldings, edges, jambs, soffits, sills etc. of such openings.

14.4.3 In case of fabricated structural steel and iron work, priming coat of paint shall be included with fabrication. Subsequent coat of paint shall be measured separately on the basis of the weight of steel work and iron work or in square meters be. In case of the trusses if measured in sqm compound girders, stanchions, lattice girders and similar work actual areas shall be measured in sqm and no extra shall be paid for painting on bolts, heads, nuts, washers etc. If rivet heads, bolt heads (with or without washers), nuts (with or without washers and including projecting portion of shank) and painted out in a tint different from that of adjacent work these shall be enumerated and measured separately.

Note: No addition shall be made to the weight calculated for the purpose of measurement of steel and iron work for the paint applied either in shop or at site.

14.4.4 Painting up to 10 cms in width or in girth and not in conjunction with similar painted work shall be measured in running meters and shall include cutting to line where so required.

14.4.5 Shall articles up to 0.1 sqm of painted surfaces, where not in conjunction with similar painted work shall be enumerated.

14.4.6 Different surface shall be grouped into one general item areas of uneven surfaces being converted into equivalent plain areas in accordance with the table below:

### Equivalent plain areas of uneven surfaces

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Description of work</th>
<th>How measured</th>
<th>Multiplying Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>(i)</td>
<td>Panelled or framed and braced or ledged and battened or ledged, battened and braced Joinery.</td>
<td>Measured flat (not girthed) including CHOWKHAT or frame. Edges, chocks, cleats etc., shall be included in the item.</td>
<td>1.33 (for each side).</td>
</tr>
<tr>
<td>S. No.</td>
<td>Description of work</td>
<td>How measured</td>
<td>Multiplying Factor</td>
</tr>
<tr>
<td>-------</td>
<td>------------------------------</td>
<td>------------------------------------------------------------------------------</td>
<td>--------------------</td>
</tr>
<tr>
<td>(ii)</td>
<td>Flush Joinery.</td>
<td>Measured flat (not girthed) including CHOWKHAT or frame. Edges, chocks, cleats etc. shall be deemed to be included in the item.</td>
<td>1.20 (for each).</td>
</tr>
<tr>
<td>(iii)</td>
<td>Fully glazed or gauged joinery.</td>
<td>Measured flat (not girthed) including CHOWKHAT or frame. Edges, chocks, cleats etc., shall be deemed to be included in the item.</td>
<td>0.80 (for each side).</td>
</tr>
<tr>
<td>(iv)</td>
<td>Partly paneled and partly glazed or gauged joinery.</td>
<td>Measured flat (not girthed) including CHOWKHAT or frame. Edges, chocks, cleats etc., shall be deemed to be included in the item.</td>
<td>1 (for each side).</td>
</tr>
<tr>
<td>(v)</td>
<td>Fully venetianed or louvered joinery.</td>
<td>Measured flat (not girthed) including CHOWKHAT or frame. Edges, chocks, cleats etc., shall be deemed to be included in the item.</td>
<td>1.80 (for each side).</td>
</tr>
<tr>
<td>(vi)</td>
<td>Weather boarding.</td>
<td>Measured flat (not girthed) supporting frame work shall not be measured separately.</td>
<td>1.20 (for each side).</td>
</tr>
<tr>
<td>(vii)</td>
<td>Wood shingle roofing.</td>
<td>Measured flat (not-girthed).</td>
<td>1.10 (for each side).</td>
</tr>
<tr>
<td>(viii)</td>
<td>Boarding with cover fillets and match boarding.</td>
<td>Measured flat (not-girthed).</td>
<td>1.05 (for each side).</td>
</tr>
<tr>
<td>(ix)</td>
<td>Tile and slate battening.</td>
<td>Measured flat overall; no deduction shall be made for open spaces.</td>
<td>0.80 (for painting all over).</td>
</tr>
<tr>
<td>(x)</td>
<td>Trellis (or JAFFRI) work one way or two way.</td>
<td>Measured flat over all; no deduction shall be made for open spaces, supporting members shall not be measured separately.</td>
<td>1 (for painting over).</td>
</tr>
<tr>
<td>S. No.</td>
<td>Description of work</td>
<td>How measured</td>
<td>Multiplying Factor</td>
</tr>
<tr>
<td>-------</td>
<td>---------------------</td>
<td>--------------</td>
<td>-------------------</td>
</tr>
<tr>
<td>(xi)</td>
<td>Guard bars, balustrades, gates, gratings, grills, expanded metal and railings.</td>
<td>Measured flat overall, no deduction shall be made for open spaces, supporting members shall not be measured separately.</td>
<td>1 (for painting all over).</td>
</tr>
<tr>
<td>(xii)</td>
<td>Gates and open palisade fencing including standards, braces, rails, stays, etc.</td>
<td>Measured flat overall; no deduction shall be made for open spaces, supporting members shall not be measured separately (see note).</td>
<td>1 (for painting all over).</td>
</tr>
<tr>
<td>(xiii)</td>
<td>Carved or enriched work.</td>
<td>Measured flat.</td>
<td>2 (for each side).</td>
</tr>
<tr>
<td>(xiv)</td>
<td>Steel roller shutters.</td>
<td>Measured flat for opening overall; jamb guides, bottom rails and locking arrangement etc. shall be included in the item. (Top cover shall be measured separately).</td>
<td>1.10 (for each side).</td>
</tr>
<tr>
<td>(xv)</td>
<td>Plain sheet steel doors and windows.</td>
<td>Measured flat (not girthed) including frame.</td>
<td>1.10 (for each).</td>
</tr>
<tr>
<td>(xvi)</td>
<td>Fully glazed or gauged steel doors and windows.</td>
<td>Measured flat (not girthed) including frame edges etc.</td>
<td>0.50 (for each).</td>
</tr>
<tr>
<td>(xvii)</td>
<td>Partly paneled and partly glazed or gauged steel doors.</td>
<td>-do-</td>
<td>0.80 (for each).</td>
</tr>
<tr>
<td>(xviii)</td>
<td>Collapsible gate.</td>
<td>Measured flat (size of opening). No separately measurements shall be taken for the top and bottom guide rails, rollers, fittings etc.</td>
<td>1.50 (for painting all over).</td>
</tr>
</tbody>
</table>

Note: For painting open palisade fencing and gates etc., the height shall be measured from the bottom of the lowest rail, if the palisades do not go below it (or
from the lower end of the palisades, if they project below the lowest rail), upto the top of rails or palisades whichever are higher, but not up to the top of standards when the latter are higher than the top rails or the palisades.

14.4.7 Where doors, window etc. are of composite types other than those included in above table, the different portion shall be measured separately with their appropriate coefficients, the centre line of the common rail being taken as the dividing line between the two portions. Measurement of painting of doors, windows, collapsible gates, rolling shutters etc. as given in table above shall be deemed to include painting if required all iron fittings in the same shade different shade for which no extra measurement shall be taken.

Measurement of painting of doors, windows, collapsible gates, rolling shutters etc. as given in table above shall be deemed to include painting if required all iron fittings in the same shade or different shade for which no extra measurement shall be taken.

When the two faces of door, window etc. are to be treated with different specified finishes measurable under separate items, the edge of frames and measurement of this will be deemed to be included in the measurement of the face treated with that finish.

In the case where shutters are fixed on both faces of the frames, the measurement for the door frame and shutter on one face shall be taken in the manner already described, while the additional shutter on the other face will be measured for the shutter area excluding the frame.

Where shutters are provided with clearance exceeding 15 cm at top or/and bottom such openings shall be deducted from the overall measurements and relevant coefficients shall be applied to obtain the area payable.

Width of moulded work of all other kinds, as in hand rails, cornices, architraves shall be measured by girth.

14.4.8 Treatment of dampness to be measured and paid separately for plastered surfaces.

14.4.9 Removal of fungus/mould growth and repairs to major cracks and defect in plaster shall be measured and paid for separately.

14.4.10 Scraping of the surface and application of suitable sealer shall be measured and paid for separately.

14.5 Rate
Rate shall include the cost of all labour and materials involved in all operations described in workmanship.
1) The through rates include the carriage of all materials for 100 meters on head load and 1 kilometre by mechanical transport. All other additional carriage shall be accounted for separately.

2) The through rates include the cost of materials, wastages, sand papers and brushes required for completion of any item. The labour rates include the cost of brushes, sand papers, scaffolding etc. and other appurtenant sundries.

3) The specification of paints especially paints and other goods shall be as notified by the Chief Engineer, Uttarakhand Pradesh P.W.D. from time to time. All items shall be paid as per latest applicable UKPWD Schedule of Rates.

Other relevant Specifications are as follows:

1. PVC DOOR SHUTTER AND FRAME WORK

1.1 PVC Door Shutters

The shutters shall be fabricated at factory as per nomenclature of the item and directions of Engineer. Shutter shall be made of PVC material conforming to IS: 10151.

1.1.1 30 mm Thick PVC Door Shutters (Fig. 30)

1.1.2 Sampling and Criteria for Conformity

1.1.2.1 General Precautions

1.1.2.1.1 The test specimens shall not have been exposed to a temperature below 40° C for 24 hours immediately preceding the test and shall be free from all visible moisture. The specimen shall be inspected and any specimen with visible flaws shall be discarded.

1.1.2.1.2 If any test specimen fails because of mechanical reason, such as failure of testing equipment or improper specimen preparation, it shall be discarded and another specimen taken.

1.1.2.2 Sampling

1.1.2.2.1 Sampling criteria for conformity shall be in accordance with IS: 4020 (Part 1).

1.1.2.2.2 Lot in any consignment of shutters shall be of the same grade and type and manufactured under similar conditions of production which shall be grouped together to form a lot.
1.1.2.2.3 The number of shutters to be selected at random from a lot shall depend upon its size and shall be in accordance with Col. 1 and Col. 2 of table below.

**No. of Sample and Criteria for Conformity**

<table>
<thead>
<tr>
<th>Lot Size</th>
<th>Sample Size</th>
<th>Permissible No. of Defects</th>
</tr>
</thead>
<tbody>
<tr>
<td>26 to 50</td>
<td>8</td>
<td>1</td>
</tr>
<tr>
<td>51 to 100</td>
<td>13</td>
<td>1</td>
</tr>
<tr>
<td>101 to 150</td>
<td>20</td>
<td>1</td>
</tr>
<tr>
<td>151 to 300</td>
<td>32</td>
<td>1</td>
</tr>
<tr>
<td>301 to 500</td>
<td>50</td>
<td>2</td>
</tr>
<tr>
<td>501 and above</td>
<td>80</td>
<td>2</td>
</tr>
</tbody>
</table>

Note: For lot size 25 or less, number of samples to be taken for testing shall be as agreed to between the manufacturer & Engineer.

Number of Tests: The samples selected as in Col. 2 of table above shall be as agreed to between the manufacturer & Engineer.

1.1.2.2.4 Criteria for Conformity

The lot shall be considered conforming to the requirements if the number of samples failing to satisfy the requirements of characteristics does not exceed the permissible number mentioned in Col. 3 of table above.

1.1.3 Test

1.1.3.1 The door shutters shall be subjected to the following tests in accordance with IS: 4020 (Part 1 to 16).

(a) Dimension and Squareness Test: Door shutters when tested in accordance with IS: 4020 (Part 2) the dimensions of nominal width and height will be within a limit of ± 5 mm. The door shutter shall not deviate by more than 1 mm on a length of 500 mm. The thickness of the door shutter shall be uniform throughout with the permissible variation of not more than 0.8 mm between any two points. The nominal thickness of the shutter shall be within a limit of ± 1.5 mm.

(b) General Flatness Test: Door shutter, when tested in accordance with IS: 4020 (Part 3) the twist, cupping and warping shall not exceed 6 mm.
(c) Local Planeness Test: Door shutters, when tested in accordance with IS: 4020 (Part 4), the depth of deviation measured at any point shall not be more than 0.5 mm.

(d) Impact Indentation Test: Door shutters, when tested in accordance with IS: 4020 (Part 5), shall have no defects such as cracking, tearing or delamination and the depth of indentation shall not be more than 0.2 mm.

(e) Edge Loading Test: Door shutters, when tested in accordance with IS: 4020 (Part 7) the deflection of the edge at the maximum load shall not be more than 5 mm. On removal of the loads, the residual deflection shall not be more than 0.5 mm, failing which the test may be repeated on the other edge in the reverse direction. Also there shall be no lateral buckling by more than 2 mm during loaded condition and no residual lateral buckling after removal of the load.

(f) Shock Resistance Test: Door shutters, when tested in accordance with 2.1 of IS: 4020 (Part 8), there shall be no visible damage in any part of the door after twenty five blows on each end.

(g) Buckling Test: Door shutters, when tested in accordance with IS: 4020 (Part 9), shall not show any deterioration and any residual deformation more than 5 mm after 15 minute of unloading and the initial deflection also shall not be more than 50 mm.

(h) Slamming Test: Door shutters, when tested in accordance with 2.1 of IS 4020 (Part 10), shall not have any damage in any part of the door at the end of successive impacts. Door shutters, when tested in accordance with 3.1 of IS: 4020 (Part 10), shall not have any visible damage in part of the door at the end of 100 successive impacts.

(i) Misuse Test: Door shutters, when tested in accordance with IS: 4020 (Part 11), there shall not be any permanent deformation of the fixing or any other part of the door set in hindering its normal working after the test.

(j) Screw Holding Test: Door shutters, when tested in accordance with IS: 4020 (Part 16), the load shall not be less than 1000 N.

(k) End Immersion Test: Door shutters, when tested in accordance with IS: 4020 (Part 13), the shutter shall not show any delamination.

(l) Knife Test: Door shutter, when tested in accordance with IS: 4020 (Part 14), the grading shall be standard & excellent.
(m) Glue Adhesion Test: Door shutters shall be tested in accordance with IS: 4020 (Part 15). There should be no delamination.

1.1.4 Fixing of Shutters

PVC door shutter shall be side hung on three bolt hinges of size 100 mm, one at the centre and the other two at 200 mm from the top and bottom of the shutter. The flat of the hinges shall be neatly counter sunk in to the recesses cut out to the exact dimensions of the hinge flap. The door shall be drilled on the thickness to fit hinges. Screws for fixing the hinges shall be screwed-in with screwdrivers and not hammered. The length of the screws should be 8 mm/30 mm. The hinges used should be of stainless steel.

1.1.5 Tolerance

The tolerance on the width and the height of the door shall be \( \pm 5 \) mm and the tolerance on the nominal thickness of the door shall be \( \pm 2 \) mm.

1.1.6 Fittings

Fittings shall be provided as per schedule of fittings decided by Engineer. In moisture prone areas M.S. fittings and screws should not be used. Hardware such as handles, tower bolt, stopper, buffer etc. should be directly screwed (not pre-drilled) and fitted on the door.

1.1.7 Measurement

Length and width of the shutters shall be measured to the nearest cm in closed position covering the rebates of the frames but excluding the gap between the shutter and the frame. Area is calculated to the nearest 0.01 sqm.

1.1.8 Rate

The specified rate includes the cost of the door shutter and labour involved in fixing of the shutter. Fittings & fixtures on the door shutter except hinges & screws shall be paid extra as provided.

1.2 PVC Door Frame

Solid PVC door frame and shutter shall be as per section 1.1 above.

1.2.1 Solid PVC Door Frames consisting of section 50 mm x 47 mm shall be fabricated from 5 mm PVC sheet having density of 600 kg/cum. The sheet used may be in plain colour, printed design or prelam veneer shade as approved by the Engineer. The weight per running metre of the door frame including reinforcement should be a minimum of 1.5 kg/sqm. The depth of the rebate of door frame shall be 10 mm. Frames shall have smooth surface, without any warping or bending in any member. All the parts of the door frame are to be joined to each other using solvent adhesive.
conforming to IS: 14182. A tolerance of ± 3 mm shall be permitted in the specified dimension of PVC section in the door frames. (Fig. 31)

The solid PVC door frames shall be fabricated in factory as per nomenclature of the item and directions of the Engineer.

1.2.2 Fixing of Frames

The frames are to be fixed in prepared openings in the walls. All civil work and tiling should be completed before the fixing of the frames. The frames are to be fixed directly on the plastered wall. In case tiling is to be done in the place the frames are to be fitted, a 50 mm strip should be left un-tiled at the location where the frames are to be fitted. The frames are erected in the prepared opening such that the vertical members of the door frame are embedded 50 mm in the floor. The frame shall be fitted truly in plumb. A minimum of three anchor bolts or screws of size 65/100 shall be used to fix each vertical member. One bolt shall be fixed at 200 mm from the top member and one bolt shall be fixed at 200 mm from the floor. The third anchor bolt shall be fixed in the center. The top horizontal member shall be fixed using two 65/100 size anchor bolts or screws at a distance of 200 mm from both the corners.

1.2.3 Measurements

The outer length of the vertical and horizontal members of PVC door frame shall be measured in running metres including embedded length in floor corrected upto a cm.

1.2.4 Rate

The rate includes the cost of the materials and labour involved in all the operations described above. The cost of anchor bolts or screws for joining the frame is included in the rate. Any other hardware, which may be required, shall be paid for separately.

1.3 Panel PVC Door Shutter

1.3.1 Panel PVC Shutters are factory made shutter and shall be brought to site fully assembled. The Solid Panel PVC Door shall be fabricated from 5 mm PVC sheet. The sheets used may be in plain colour, printed design or prelam veneer shade as approved by the Engineer. The shutters shall be fabricated at factory as per nomenclature of the item and directions of the Engineer.

(a) 30 mm thick panel PVC door shutters (Fig. 32).

1.3.2 Sampling and Criteria for Conformity

As per Clause 1.1.2 above.

1.3.3 Tests

As per Clause 1.1.3 above except para (k), (l) & (m).
1.3.4 Fixing of Shutters
As per Clause 1.1.4 above. In addition, it may be ensured that while fixing hinges the screws pass through the two opposite surfaces of the M.S. reinforcement.

1.3.5 Tolerance
As per Clause 1.1.5 above.

1.3.6 Fittings
As per Clause 1.1.6 above.

1.3.7 Measurements
As per Clause 1.1.7 above.

1.3.8 Rate
As per Clause 1.1.8 above.

2. EXTERIOR PAINTING ON WALL

2.1 Material
The paint shall be (Weather proof exterior grade emulsion of approved design/Textured exterior paint/Acrylic smooth exterior paint/Premium acrylic smooth exterior paint) as specified or of approved brand and manufacture.

This paint shall be brought to the site of work by the Contractor in its original containers in sealed condition. The material shall be brought in at a time in adequate quantities to suffice for the whole work or at least a fortnight’s work. The materials shall be kept in the joint custody of the Contractor and the Engineer. The empty containers shall not be removed from the site of work till the relevant item of work has been completed and permission obtained from the Engineer.

2.2 Preparation of Surface
For new work, the surface shall be thoroughly cleaned off all mortar dropping, dirt dust, algae, fungus or moth, grease and other foreign matter of brushing and washing, pitting in plaster shall make good, surface imperfections such as cracks, holes etc. should be repaired using white cement. The prepared surface shall have received the approval of the Engineer after inspection before painting is commenced.

2.3 Application
Base coat of water proofing cement paint:

2.3.1 All specifications in respect of base coat of water proofing Cement Paint shall be as described below.
2.3.1.1 Material

The Cement Paint shall be (conforming to IS: 5410) of approved brand and manufacture.

The other paint work conditions when brought to site shall be as per specifications given in second para in 2.1 above.

2.3.1.2 Preparation of Surface

For New Work, the surface shall be thoroughly cleaned of all mortar dropping, dirt dust, algae, grease and other foreign matter by brushing and washing. Pitting in plaster shall be made good and a coat of water proof Cement Paint shall be applied over patches after wetting them thoroughly.

2.3.1.3 Preparation of Mix

Cement Paint shall be mixed in such quantities as can be used up within an hour of its mixing as otherwise the mixture will set and thicken, affecting flow and finish. Cement Paint shall be mixed with water in two stages. The first stage shall comprise of 2 parts of cement Paint and one part of water stirred thoroughly and allowed to stand for 5 minutes. Care shall be taken to add the Cement Paint gradually to the water and not vice versa. The second stage shall comprise of adding further one part of water to the mix and stirring thoroughly to obtain a liquid of workable and uniform consistency. In all cases the manufacturer’s instructions shall be followed meticulously.

The lids of Cement Paint drums shall be kept tightly closed when not in use, as by exposure to atmosphere the Cement Paint rapidly becomes air set due to its hygroscopic qualities.

In case of Cement Paint brought in gunny bags, once the bag is opened, the contents should be consumed in full on the day of its opening. If the same is not likely to be consumed in full, the balance quantity should be transferred and preserved in an airtight container to avoid its exposure to atmosphere.

2.3.1.4 Application

2.3.1.4.1 The solution shall be applied on the clean and wetted surface with brushes or spraying machine. The solution shall be kept well stirred during the period of application. It shall be applied on the surface which is on the shady side of the building so that the direct heat of the sun on the surface is avoided. The method of application of cement Paint shall be as per manufacturer’s specification. The completed surface shall be watered after the day’s work.
2.3.1.4.2 The second coat shall be applied after the first coat has been set for at least 24 hours. Before application of the second or subsequent coats, the surface of the previous coat shall not be wetted.

2.3.1.4.3 For new work, the surface shall be treated with three or more coats of water proof cement Paint as found necessary to get a uniform shade.

2.3.1.4.4 For old work, the treatment shall be with one or more coats as found necessary to get a uniform shade.

2.3.1.5 Precaution

Water proof cement Paint shall not be applied on surfaces already treated with white wash, colour wash, distemper dry or oil bound, varnishes, Paints etc. It shall not be applied on gypsums, wood and metal surfaces.

If water proofing cement is required to be applied on existing surface, previously treated with white wash, colour wash etc., the surface shall be thoroughly cleaned by scrapping off all the white wash, colour wash etc. completely. Thereafter, a coat of cement primer shall be applied followed by two or more coat of water proof cement.

2.3.1.6 The specifications in respect of scaffolding, protective measures, measurements and rate shall be as described below. The coefficient for Cement Paint on RCC Jalli shall be the same as provided for painting trellis for Jaffri work one-way or two-way i.e. 2 (for painting all over) measured flat overall, no deduction shall be made for open spaces, supporting members shall not be measured separately.

2.3.1.6.1 Scaffolding

2.3.1.6.1.1 Wherever scaffolding is necessary, it shall be erected on double supports tied together by horizontal pieces, over which scaffolding planks shall be fixed. No ballies, bamboos or planks shall rest on or touch the surface which is being white washed/painted.

2.3.1.6.1.2 For all exposed brick work or tile work, double scaffolding having two sets of vertical supports shall be provided. The supports shall be sound and strong, tied together with horizontal pieces over which scaffolding planks shall be fixed.

Note: In case of special type of brick work, scaffolding shall be got approved from the Engineer in advance.

2.3.1.6.1.3 Where ladders are used, pieces of old gunny bags shall be tied on their tops to avoid damage or scratches to walls.

2.3.1.6.1.4 For white washing/painting the ceiling, proper stage scaffolding shall be erected.

2.3.1.6.2 Protective Measures
Doors, windows, floors, articles of furniture etc. and such other parts of the building not to be white washed/painted, shall be protected from being splashed upon. Splashings and droppings, if any shall be removed by the Contractor at his own cost and the surfaces cleaned. Damages if any to furniture or fittings and fixtures shall be recoverable from the Contractor.

2.3.1.6.3 Measurements

2.3.1.6.3.1 Length and breadth shall be measured correct to a cm. and area shall be calculated in sqm correct to two places of decimals.

2.3.1.6.3.2 Measurements for Jambs, Soffits and Fills etc. for openings shall be as described below.

Deductions in measurements, for opening etc. will be regulated as follows:

(a) No deduction will be made for openings or ends of joists, beams, posts, girders, steps etc. upto 0.5 sqm in area and no additions shall be made either, for the jambs, soffits and sills of such openings. The above procedure will apply to both faces of wall.

(b) Deduction for opening exceeding 0.5 sqm but not exceeding 3 sqm each shall be made for reveals, jambs, soffits sills, sills, etc. of these openings.

(i) When both faces of walls are plastered with same plaster, deductions shall be made for one face only.

(ii) When two faces of walls are plastered with different types of plaster or if one face is plastered and other is pointed or one face is plastered and other is unplastered, deduction shall be made from the plaster or pointing on the side of the frame for the doors, windows etc. on which width of reveals is less than that on the other side but no deduction shall be made on the other side. Where width of reveals on both faces of wall is equal, deduction of 50% of area of opening on each face shall be made from area of plaster and/or pointing as the case may be.

(iii) For opening having door frame equal to or projecting beyond thickness of wall, full deduction for opening shall be made from each plastered face of wall.

(c) For opening exceeding 3 sqm in area, deduction will be made in the measurements for the full opening of the wall treatment on both faces, while at the same time, jambs, sills and soffits will be measured for payment.

In measuring jambs, sills and soffits, deduction shall not be made for the area in contact with the frame of doors, windows etc.
2.3.1.6.3.3 Corrugated surfaces shall be measured flat as fixed and the area so measured shall be increased by the following percentages to allow for the girthed area:

<table>
<thead>
<tr>
<th>Surface</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corrugated non-asbestos cement</td>
<td>20%</td>
</tr>
<tr>
<td>Semi corrugated non-asbestos cement sheet</td>
<td>10%</td>
</tr>
</tbody>
</table>

2.3.1.6.3.4 Cornices and other such wall or ceiling features, shall be measured along the girth and included in the measurements.

2.3.1.6.3.5 The number of coats of each treatment shall be stated. The item shall include removing nails, making good holes, cracks, patches etc. not exceeding 50 sqcm each with material similar in composition to the surface to be prepared.

2.3.1.6.3.6 Work on old treated surfaces shall be measured separately and so described.

2.3.1.6.4 Rate

The rate shall include all material and labour involved in all the operations described above.

2.3.2 Before pouring into smaller containers for use, the paint shall be stirred thoroughly in its container, when applying also the paint shall be continuously stirred in the smaller containers so that its consistency is kept uniform. Dilution ratio of paint with potable water can be altered taking into consideration the nature of surface climate and as per recommended dilution given by manufacturer. In all cases, the manufacturer’s instructions & directions of the Engineer shall be followed meticulously.

The lids of paint drums shall be kept tightly closed when not in use as by exposure to atmosphere the paint may thicken and also be kept safe from dust.

2.3.3 Paint shall be applied with a brush on the cleaned and smooth surface. Horizontal strokes shall be given, First and vertical strokes shall be applied immediately afterwards. This entire operation will constitute one coat. The surface shall be finished as uniformly as possible leaving no brush marks.

2.4 The specifications in respect of scaffolding, protective measures, measurements and rate shall be as described in para 2.3.1.6 above.

Overhead Tank:-

Polyethylene water storage tank should be ISI : 12701 marked with cover and suitable locking arrangement and making necessary holes for inlet, outlet and overflow pipes.
7 Dismantling and demolition

Scope

This work shall consist of removing, as hereinafter set forth, existing buildings, roofs, ceiling, flooring and paving, concrete and brick roofs and suspended floors, walls and columns, reinforced concrete and brick work, partitions, wood work, steel and iron work, doors and windows, pipes and sewer lines, posts or struts, fencing wire mesh, glazing, culverts, bridges, pavements, kerbs and other structures like guard-rails, utility services, catch basins, inlets, etc., which are in place but interfere with the new construction or are not suitable to remain in place, and of salvaging and disposing of the resulting materials and back filling the resulting trenches and pits.

Existing culverts, bridges, pavements and other structures which are within the highway and which are designated for removal, shall be removed up to the limits and extent specified in the Drawings or as indicated by the Engineer.

Dismantling and removal operations shall be carried out with such equipment and in such a manner as to leave undisturbed, adjacent pavement, structures and any other work to be left in place.

All operations necessary for the removal of any existing structure which might endanger new construction shall be completed prior to the start of new work.

Applicable Codes

<table>
<thead>
<tr>
<th>Code Reference</th>
<th>Description</th>
</tr>
</thead>
</table>

Terminology

The term ‘Dismantling’ implies carefully separating the parts without damage and removing. This may consist of dismantling one or more parts of the structure as specified or shown on the Drawings.
The term ‘Demolition’ implies breaking up. This shall consist of demolishing whole or part of work including all relevant items as specified or shown on the Drawings.

Buildings

Precautions

All materials obtained from dismantling or demolition shall be the property of the Employer unless otherwise specified and shall be kept in safe custody until they are handed over to the Engineer.

The demolition shall always be well planned before hand and shall generally be done in reverse order of the one in which the structure was constructed. The operations shall be got approved from the Engineer-In-Charge before starting the work.

Due care shall be taken to maintain the safety measures prescribed in IS: 4130.

Necessary propping, shoring and or under pinning shall be provided to ensure the safety of the adjoining work or property before dismantling and demolishing is taken up and the work shall be carried out in such a way that no damage is caused to the adjoining work or property. Wherever specified, temporary enclosures or partitions shall also be provided, as directed by the Engineer.

Necessary precautions shall be taken to keep down the dust nuisance to the minimum.

Dismantling shall be done in a systemic manner. All materials which are likely to be damaged by dropping from a height or by demolishing roofs, masonry etc. shall be carefully removed first. The dismantled articles shall be removed manually or otherwise, lowered to the ground (and not thrown) and then properly stacked as directed by the Engineer.

Where existing fixing is done by nails, screws, bolts, rivets, etc., dismantling shall be done by taking out the fixing with proper tools and not by tearing or ripping off.

Any serviceable material, obtained during dismantling or demolition, shall be separated out and stacked properly as directed by the Engineer within a lead of 50 m. All unserviceable materials rubbish etc. shall be disposed off as directed by the Engineer.

The Contractor shall maintain / disconnect existing services, whether temporary or permanent, where required by the Engineer.
Measurements

All work shall be measured net in the decimal system, as fixed in its place, subject to the following limits, unless otherwise stated hereinafter.

1. Dimensions shall be measured correct to a cm.
2. Areas shall be worked out in sq mt correct to two places of decimal.
3. Cubical contents shall be worked out to the nearest 0.01 cum.

Parts of work required to be dismantled and those required to be demolished shall be measured separately.

Measurements of all works except hidden work shall be taken before demolition or dismantling and no allowance for increase in bulk shall be allowed.

Specifications for deduction for voids, openings etc. shall be on the same basis as that adopted for new construction of the work.

Work executed in the following conditions shall be measured separately:

1. Work in or under water and / or liquid mud;
2. Work in or under foul position.

Rates

The rate shall include the cost of all labour involved and tools used in demolishing and dismantling including scaffolding. The rate shall also include the charges for separating out and stacking the serviceable material properly and disposing off unserviceable material within a distance of 50 m.

The rate shall also include for temporary shoring for the safety of portions not required to be pulled down, or of adjoining property, and providing temporary enclosures or partitions, where considered necessary.

Roofs

Roof coverings generally including battens boarding, mats, bamboo jaffari or other subsidiary supports shall be measured in sq mt except lead sheet roof covering, which shall be measured in quintals (Clause 3.5.4) and stone slab roof covering which shall be measured in cum.
Ridges, hips and valleys shall be girthed and included with the roof area. Corrugated or semi corrugated surfaces shall be measured flat and not girthed.

Mud phuska on roofs shall be measured in cum.

Lead sheets in roofs shall be measured in quintals and hips, valleys, flashings, lining to gutter etc. Shall be included in this weight.

R.B. or R.C.C. roofs shall be measured as specified in Clause 3.10.

Supporting members, such as rafters, purlins, beams joists, trusses etc. where of wood shall be measured in cum and steel or iron sections in quintals.

Ceiling

The stripping of ceilings shall be measured in sqm.

Dismantling of supporting joists, beams, etc. shall be measured in cum or in quintals as specified in Clause 3.5.6.

Height above floor levels if it exceeds 3.5 m shall paid for separately.

Flooring and Paving

Dismantling of floors (except concrete and brick floors) shall be measured in sqm. Supports such as joints, beams etc. if any shall be measured as per Clause 3.5.6. Concrete and bricks paving shall be measured as per Clause 3.8.

Concrete and Brick Roofs and Suspended Floors

Demolition of floors and roofs of concrete or brick shall be measured in cum. Beams cantilevers or other subsidiary supports of similar materials shall be included in the item. In measuring thickness of roofs provided with water proofing treatments with bitumen, felts, the thickness of water proofing treatment shall be ignored.

Walls and Piers

Taking down walls and independent piers or columns of brick, stone or concrete shall be measured, in cum. All copings, corbels, cornices and other projections shall be included with the wall measurements.
In measuring thickness of plastered walls, the thickness of plaster shall be ignored.

Ashlar face stones, dressed stone work, precast concrete articles, etc. if required to be taken down intact shall be so stated, and measured separately in cum.

Cleaning bricks stacking for measurements including all extra handling and removal and disposing off the rubbish as stated shall be enumerated in thousand of cleaned bricks.

Cleaning stone obtained from demolished / dismantling stone masonry of any description including ashlar facing dressed stone work, stone slabs or flagging and precast concrete blocks including all extra handling and disposing of the rubbish as stated shall be measured in cum of cleaned stone.

Honey comb works or cavity walls of bricks stone or concrete shall be measured as solid.

**Reinforced Concrete and Brick Work**

Reinforced concrete structures and reinforced brick roof and walls shall be measured in cum and if reinforcement is required to be salvaged, it shall be so stated.

Where reinforcement is required to be separated, scraped and cleaned, the work shall be measured separately in quintal of salvaged steel.

**Partitions, Trellis Work, Etc.**

Partitions or light walls of lath and plaster, trellis work, expanded metal, thin concrete or terracotta slabs and other similar materials including frame work if any shall be measured in sqm stating the over all thickness.

**Wood Work**

All wood work including karries average 40 sq cm or over in section, shall be measured in cum, while that under 40 sq cm in section, in running metres. Ballies shall be measured in running metres.

Boarding including wooden chaijas and sun shades along with supports shall be measured in
Steel and Iron Work

All steel and iron work shall be measured in quintals. The weight shall be computed from standard tables unless the actual weight can readily be determined.

Riveted work, where rivets are required to be cut, shall be measured separately.

Marking of structural steel required to be re-erected shall be measured separately.

In framed steel items, the weight or any covering material or filling such as iron sheets and expanded metal shall be included in the weight of the main article unless such covering is not ordered to be taken out separately.

Doors and Windows

Dismantling of doors, windows, clerestory windows, ventilators etc. (Wood or metal) whether done separately or along with removal of wall by making recess in the wall shall be enumerated. Those exceeding 3 sqm each in area shall be measured separately. The item shall include removal of chowkhat architraves, hold fasts and other attachments.

If only shutters are to be taken out it shall be measured separately.

Pipes and Sewer Lines

Water pipe lines including rain water pipes with clamps and specials, sewer lines (salt glazed ware or concrete) etc. shall be described by their diameter and length measured in running m inclusive of joints.

If the joints, special and fittings etc. Are required to be separated, it shall be so stated and enumerated.

Pucca drains shall be measured under relevant items.

Value cistern, public fountain platform, fire hydrants, etc. shall be enumerated.
Manholes and inspection chambers shall be enumerated stating the size and depth of manhole/inspection chamber. They shall be classified into different groups depending upon the depth, in unit of half and one m depth. The depth of the manhole shall be the distance between the top of manhole cover and invert level of the drain.

Ventilating shafts, gully traps, flushing cisterns and other appurtenant items of work shall be enumerated.

**Posts or Struts**

Posts or struts (wood, steel or RCC) section including taking out embedded portion shall be measure running m.

**Fencing Wire Mesh**

Wire mesh fencing of any type with frame shall be measured in square m.

**Glazing**

Taking out any portion of serviceable glass except polished plate, from old sashes, skylights, etc. (any thickness, weight or size) raking out old putty, etc. shall be measured in square m.

Irregular or circular panes shall be measured as rectangle or square enveloping the same. The width and height being measured correct to the nearest 0.5 cm.

**Dismantling Culverts, Bridges and Other Structures/Pavements**

**Dismantling Culverts and Bridges**

The structures shall be dismantled carefully and the resulting materials so removed as not to cause any damage to the serviceable materials to be salvaged, the part of the structure to be retained and any other properties or structures nearby.

Unless otherwise specified, the superstructure portion of culverts / bridges shall be entirely removed and other parts removed below the ground level or as necessary depending upon the interference they cause to the new construction. Removal of overlaying or adjacent material, if required in connection with the dismantling of the structures shall be incidental to this item.
Where existing culvert / bridges are to be extended or otherwise incorporated in the new work, only such part or parts of the exiting structure shall be removed as are necessary and directed by the Engineer to provide a proper connection to the new work. The connecting edges shall be cut, chipped and trimmed to the required lines and grades without weakening or damaging any part of the structure to be retained. Due care should be taken to ensure that reinforcing bars which are to be left in place to project into the new work as dowels or ties are not injured during removal of concrete.

Pipe culverts shall be carefully removed in such manner as to avoid damage to the pipes.

Steel structures shall, unless otherwise provided, be carefully dismantled in such a manner as to avoid damage to members thereof. If specified in the Drawings or directed by the Engineer that the structure is to be removed in a condition suitable for re-erection, all members shall be match-marked by the Contractor with white lead paint before dismantling; end pins, nuts, loose plates, etc., shall be similarly marked to indicate their proper location; all pins, pin holes and machined surfaces shall be painted with a mixture of white lead and tallow and all loose parts shall be securely wired to adjacent members or packed in boxes.

Timber structures shall be removed in such a manner as to avoid damage to such timber or lumber when designated by the Engineer to be salvaged.

**Dismantling Pavements and Other Structures**

In removing pavements, kerbs, gutters and other structures like guard-rails, fences, manholes, catch-basins, inlets, etc. where portions of the existing construction are to be left in the finished work, the same shall be removed to an existing joint or cut and chipped to a true line with a face perpendicular to the surface of the existing structure. Sufficient removal shall be made to provide for proper grades and connections with the new work as directed by the Engineer.

All concrete pavements, base courses in carriageway and shoulders etc., designated for removal shall broken to pieces whose volume shall not exceed 0.02 cum and stockpiled at designated locations if the material is to be used later or otherwise arranged for disposal as directed (see Clause 3.19.4).

**Back-filling**

Holes and depressions caused by dismantling operations shall be backfilled with excavated or
other approved materials and compacted to required density as directed by the Engineer.

Disposal of Materials

All materials obtained by dismantling shall be the property of Employer. Unless otherwise specified, materials having any salvage value shall be placed in neat stacks of like materials within the right-of-way, as directed by the Engineer with all lifts and up to a lead of 1000 m.

Pipe culverts that are removed shall be cleaned and neatly piled on the right-of-way at points designated by the Engineer with all lifts and lead up to 1000 m.

Structural steel removed from old structures shall, unless otherwise specified or directed, be stored in a neat and presentable manner on blocks in locations suitable for loading. Structures or portions thereof which are specified in the Contract for re-erection shall be stored in separate piles.

Timber or lumber from old structures which is designated by the Engineer as materials to be salvaged shall have all nails and bolts removed there from and shall be stored in neat piles in locations suitable for loading.

All materials obtained from dismantling operations which, in the opinion of the Engineer, cannot be used or auctioned shall be disposed of as directed by the Engineer with all lifts and up to a lead of 1000 m.

Measurements for Payment

The work of dismantling structures shall be paid for in units indicated below by taking measurements before and after, as applicable:

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Dismantling brick/stone masonry/concrete (plain and reinforced)</td>
</tr>
<tr>
<td>2.</td>
<td>Dismantling flexible and cement concrete pavement</td>
</tr>
<tr>
<td>3.</td>
<td>Dismantling steel structures</td>
</tr>
<tr>
<td>4.</td>
<td>Dismantling timber structures</td>
</tr>
<tr>
<td>5.</td>
<td>Dismantling pipes, guard rails, kerbs, gutters and fencing</td>
</tr>
<tr>
<td>6.</td>
<td>Utility services</td>
</tr>
</tbody>
</table>
6.4 General Specifications for Electrical Works:

1.1 GENERAL REQUIREMENTS

The electrical installation work shall generally be carried out in conformity with the requirements of the Indian Electricity Act, 1910 as amended up to date and the Indian Electricity Rules, 1956 framed thereunder, the relevant regulations of the Electric Supply Authority concerned, and also with the specifications laid down in the Indian Standard I.S. 732-1983 Code of Practice (revised) for Electrical Wiring Installations (System voltage not exceeding 650 volts) IS : 2274 – Code of practice (revised) for Electrical Wiring Installations (system voltage exceeding 650 Volts) and I.S. 2309-1983 Code of Practice for the protection of Buildings and Allied Structures against lightning. The wiring shall also be according to the specifications of Local Authority and N.E.C.

Electrical Installation work shall be carried out only by Contractor / Contractors holding valid Electrical contractors’ licence issued by the concerned State Government as applicable to the voltage grade and nature of electrical installation work in accordance with Rule 45 of Indian Electricity Rules, 1956 with its latest amendments. The work shall also be carried out under the direct supervision of a person holding a valid certificate of competency and by a person holding valid Licence/permit issued or recognised by the concerned State Government.

1.2 MATERIALS

All materials, fittings, appliances, items, components used in electrical installations, shall conform to relevant Indian Standard Specifications wherever these exist.

1.3 CODES AND STANDARDS

Following codes and standards are to be referred to as amended up to date in connection in the manufacturing, installation testing and commissioning of the equipments and materials but not limited to the followings:

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>IS : 12729</td>
<td>General requirements of Switchgear and control gears for voltages exceeding 1000 v.</td>
</tr>
<tr>
<td>IS : 3427</td>
<td>Metal enclosed switchgear and control gears for voltages above 1000 v.</td>
</tr>
<tr>
<td>IS : 2516</td>
<td>Specifications for Alternating current circuit</td>
</tr>
<tr>
<td>Code</td>
<td>Description</td>
</tr>
<tr>
<td>------</td>
<td>-------------</td>
</tr>
<tr>
<td>IS : 13947</td>
<td>Specification for low voltage switchgears and control gears</td>
</tr>
<tr>
<td>IS : 375</td>
<td>Specification for bus bar marking</td>
</tr>
<tr>
<td>IS : 2705</td>
<td>Specification current transformers</td>
</tr>
<tr>
<td>IS : 3516</td>
<td>Specification for voltage transformers</td>
</tr>
<tr>
<td>IS : 1248</td>
<td>Specification for electrical indicating instruments</td>
</tr>
<tr>
<td>IS : 2419</td>
<td>Specification for electrical indicating instruments</td>
</tr>
<tr>
<td>IS : 3213</td>
<td>Specification for electrical relays for power system protection</td>
</tr>
<tr>
<td>IS : 6875</td>
<td>Specification for control switches and push button</td>
</tr>
<tr>
<td>IS : 694</td>
<td>Specification for PVC insulated cables for up to 1100 v grade</td>
</tr>
<tr>
<td>IS : 1554</td>
<td>Specification for PVC insulated cables for voltages up to 1100 v grade (Heavy duty)</td>
</tr>
<tr>
<td>IS : 7098</td>
<td>Specification for XLPE insulated cables for voltages up to 33 KV</td>
</tr>
<tr>
<td>IS : 1255</td>
<td>Specification for installation and maintenance of underground cables.</td>
</tr>
<tr>
<td>IS : 3961</td>
<td>Specification for current ratings of cables</td>
</tr>
<tr>
<td>IS : 3043</td>
<td>Code of practice for earthling</td>
</tr>
<tr>
<td>IS : 732</td>
<td>Code of practice for Electrical wiring and installation (system voltage not exceeding 650 v)</td>
</tr>
<tr>
<td>IS : 2309</td>
<td>Code of practice for Lightning protection of building and structures</td>
</tr>
<tr>
<td>IS : 12640</td>
<td>Specification for residual current circuit breakers</td>
</tr>
<tr>
<td>IS : 9537</td>
<td>Specification for conduits for Electrical wiring</td>
</tr>
<tr>
<td>IS : 13032</td>
<td>Specification for universal mounting with copper busbars, neutral link earth work, earthing studs and inter connecting wires</td>
</tr>
<tr>
<td>IS : 325</td>
<td>Specification for A.C. Inductor motors</td>
</tr>
<tr>
<td>IS : 4691</td>
<td>Specification of protective enclosers for electrical items</td>
</tr>
<tr>
<td>IEC : 60947</td>
<td>International Standard for low voltage switchgears and control gears (voltage not exceeding 1000 v)</td>
</tr>
<tr>
<td>IEC : 60898</td>
<td>International Standard for low voltage switch gear</td>
</tr>
</tbody>
</table>
Whenever any materials/equipment offered do not conform to the IS or IEC specification, the bidder shall have to substantiate the superiority of the materials/equipments offered by them over IS & IEC specification.

1.4 ELIGIBILITY FOR AWARD OF CONTRACTS

Only contractor having valid electrical contractors licence of the concerned state and for doing the category of work listed in the enclosed specification shall be eligible. A Xerox copy of such licence shall be enclosed with the contract offer duly attested.

The bidder shall have to submit documents in support of validity of their electrical contractor's licence for the State of Uttarakhand time to time and during execution of the work.

The contractor shall ensure that all the above statutory licences are renewed before they lapse, during the tenure of this work and all such renewal documents/licences shall be submitted to Employer/Employer's representative time to time for record.

Employer/Employer's representative shall have the right to call for verification of all documents/licences as and when called by them or their authorized representative.

1.5 CONTRACTOR TO PROVIDE

The contractor shall have to arrange for the work to be supervised by a whole time licensed Supervisor holding valid supervisory licence of the state for the requisite part, who will be available at all reasonable hours at site to receive instructions from the Employer/Employer's representative.

The contractor shall provide and maintain proper shed/storage space for storage and protection of tools, materials etc and arrange for watchmen for protection of materials and executed works.

The technicians and supervisors of the contractor shall always carry with them measuring tape (30 metres) one test lamp with leads and one neon tester and make available to the Employer/Employer's representative all the measuring instrument and tools that are required for checking the work up to their full satisfaction.
The contractor shall keep one copy of all drawings and specifications of the work at the site in good order and shall be made available to the Employer and Employer’s representative for inspection or for such other purpose the Employer or Employer’s representative may require.

The contractor shall keep a Site Instruction Book wherein the directions or instructions given at site by the Employer/Employer’s representative will be recorded (except where such directions or instruction are given by separate letters) and he will carry out the directions/instruction recorded in the Site Instruction Book and signed by the Employer/Employer’s representative.

1.6 PROCUREMENT OF STEEL

The Contractor will have to procure steel for his requirement on his own at his own cost. No claim in this respect shall be entertained and made.

1.7 PROCUREMENT OF CEMENT

The Contractor will have to procure cement for his requirement on his own at his own cost. No claim in this respect shall be entertained and made.

1.8 WIRES AND CABLES

All wires and cables to be used in electrical works shall have all the markings on it at a regular intervals in conformity with IS / IEC. Necessary test certificates of the wires and cables shall be submitted as per IS / IEC specifications.

1.9 CONDUITS

The conduits to be used in wiring shall conform to I.S. 9537 (Part-II/III) - 1981 as amended upto date. The contractors using the particular brand of conduit shall furnish test certificate from N.T.H or any Government Approved Laboratory with each quantity of supply along with supply of conduits.

1.10 TESTING

The following items supplied by the contractor will be routine tested at the manufacturers works/approved Government Laboratory as per the relevant Indian Standards/IEC and the relevant test certificates duly signed by the testing Engineers of manufacturer shall be submitted by the contractors for the items and seeking permission for despatch from Employer/Employer’s representative:
i) L T Panels and its components
ii) MCCBs/SFUs
iii) Meters and relays
iv) Cables and wires
v) MCB DBs and their components
vi) Conduits and accessories
vii) Other items if any as called for by the Employer/ Employer’s representative

The contractor while submitting the work programme shall include provision for testing at manufacturer works delivery installation of the above items at site etc. For other items not covered above, the contractor shall furnish manufacturer’s test certificates. The Employer/Employer’s representative, however, have the right to secure samples from site and send for testing at any other laboratory at the contractors cost.

The contractor should also undertake at site all pre-commissioning tests as per relevant Indian Standards/IEC/Indian Electricity Rules and as directed by the Directorate of Electricity WB, Power Supply Authority etc in the presence of representatives of the Employer/Employer’s representative and statutory authorities/supply authorities as necessary. All the above arrangements have to be made by the contractor at his cost.

1.11 TEST CERTIFICATE

The Contractor shall have to furnish manufacturer’s test certificates, of all the major items brought at site for incorporation in work.

Certificates of High Voltage Insulation Tests, Conductivity Tests and any other tests required as per specifications are to be procured and furnished by the Electrical Contractor. The contractor shall have to get the materials tested as per IS / IEC specifications from an approved test laboratory and use them at site only if it pass the tests. All the testing shall be done by the contractor at his cost. Samples for testing will be drawn jointly by the Employer/Employer’s representative and Contractor’s representative. For other items like Bare Copper Wires etc manufacturer’s test certificate/ISI/IEC Certificate shall be submitted for acceptance.

1.12 LICENSEES REQUIREMENTS ETC

The contractor should ensure that all installations conform to Local/Statutory Regulations and requirements. In case of any deficiency/discrepancy or contradictions found in the Technical
Specifications or Schedule of Items, these shall be immediately brought to the notice of the Employer/Employer’s representative and the same should be got modified before execution of the work without any extra cost to employer.

1.13 EFFECTING CONNECTION & COMMISSIONING, ELECTRICAL INSPECTION ETC

The Employer will apply for Power Service Connection, approval from statutory Authority etc. However, the contractor shall be responsible for collection of all the necessary forms required for such Service Connection and Electrical Inspection etc and are to be duly filled up by the contractor and got it signed by the authorised person of Employer, as necessary. Contractor shall have to submit the same to the Dept on behalf of the Employer and follow up the matter with department time to time as necessary for timely completion and energisation of the electrical work covered under this specification.

The contractor will have to carry out all the formalities with the Licensee/Power Supply Authority including negotiations for strengthening/augmentation / extension of the existing service lines for the subject installation, as required. No extra claim in this regard will be entertained by the Employer due to the reason whatsoever.

The Contractor has to take all the initiatives/responsibility to get the Electrical Installation inspected and passed by the Electrical Inspector/Local Authority in all respects including any variations, alterations and modifications pointed out by the Licensees/ Inspector during inspection or at a later date for the purpose of regular use of the completed work.

The contractor shall submit all necessary drawings and details required by the various authorities and shall also be totally responsible for obtaining timely approval of the drawings as well as for timely energisation of the completed installation without delay.

1.14 SAFETY CODE

The Safety Code will be as per Indian Electricity Rules 1956 and subsequent amendments made up to date, and as per various prevailing IS/IEC Codes of Practice for Electrical Installation.

Temporary Electrical Wiring shall be done in the manner as advised by the Employer/Employer’s representative with necessary supports when drawn overhead with proper clamping/fixing and should conform to requirement of Indian Electricity Rules, various IS/IEC Codes of Practice for Electrical Installation and Local Regulations.
2.0 PARTICULAR SPECIFICATION

2.1 SPECIFICATION FOR LT SWITCH BOARD

2.1.1 Scope

This specification covers the requirements of design, manufacture, supply testing, erection and commissioning of extensible, multi-tier, multi-panel cubicle type single front construction switch board as per requirement and to be installed in the LT rooms as marked.

The LT supply from supplier’s point shall be received by the owner at their Main L.T Panel board located in the LT Room for feeding the loads of the buildings and area lighting of the premises through UG cables. Power supply for the subsequent internal distribution within the building shall be via DBs and wirings. All electrical distribution work from the of the supply authority’s supply point and up to the respective distribution points of the buildings including the area lighting shall be within the scope of this contract.

2.1.2 Ambient Conditions

The Switchboard shall be suitable for continuous operation at rated load for maximum ambient temperature of 500 C and maximum relative humidity of 100%, the maximum temperature and humidity, however, not occurring simultaneously.

2.1.3 Standards & Codes

All switch-gear and other equipment incorporated in the switch board shall comply with, but not be limited to the following:

I.S 13947 (IEC 60947) : Moulded Case Circuit Breaker, Fuse Switch Units, contactors etc. and Metal enclosed switchgears
I.S 2705 : Current Transformers
I.S 1248 & 2419 : Indicating Instruments
I.S 3231 : Protective Relays
I.S 375 : Busbar Markings
I.S 1554 : Cables

2.1.4 Electrical System

HT supply Voltage : 11 KV ± 10% (by Supplier)

Transformer
Primary : 11 KV

Secondary : 0.433 KV Star with directly earthed neutral

Short Circuit Level : 150 MVA Symmetrical at 11 KV
10 MVA Symmetrical at 415 V

L T Voltage : 433 volts, 3 phase, 4 wire (earthed neutral)
(OCV)

Frequency : 50 Hz ± 3%

2.1.5 Operational Requirement

The LT switchboard shall be extensible type and suitable for coupling for future extension of switch boards through the bus bars on either side.

2.1.6 Equipment Details

2.1.6.1 General

LT switchboard shall be floor mounting, vertical fully compartmentalised front operated free standing with jig set pressed and formed sheet steel cubicle having tiered compartments. The switch board shall be extensible on either sides with single front arrangement as per requirement with two sides access. The thickness of sheet steel of the enclosures shall be not less than 2.0 mm for outside walls and the partition walls not less than 1.6 mm.
The compartments housing front operated MCCB/SFU units with components mounted on chassis plate having incoming and outgoing power and control terminals in the cable compartment.

All Panel doors shall be interlocked with corresponding switches enclosed and all live parts shall be fully shrouded. All cable termination points shall have insulating/metal shields to prevent accidental contacts during maintenance and inspection of cable alleys. All terminals shall be busbar type suitable to connect the required number and size of cables considered. Feeder compartments and cable compartment shall be provided with hinged door with screw knob arrangement whereas the busbar compartment shall be provided with bolted type arrangement.

2.1.6.2 Equipment Details

All technical requirements of different circuits of switchboard are furnished in the schematic electrical single line diagram and schedule of items attached.

The switch board shall comprise of all component units of reputed makes. Only one make for MCCB/SFU shall be used.

2.1.6.3 Switchboard Construction

The switchboard shall be constructed from 14 SWG (2 mm thick). M.S Sheets with integral angle iron frame work as required.

The switch board shall be provided with mounting channels (size ISMC 100 x 50 mm) at bottom, covered by skirtings. Foundation bolt hole shall have easy accessibility.

Each section of the vertical panel shall comprise of one busbar chamber/compartment, one feeder equipment compartment and one cable chamber/compartment. Each chamber shall be fully segregated with 1.6 mm thick sheet steel all round.

All cables shall enter from bottom having drilled gland plates for fixing single compression type cable gland and routed through a cable alley.
The hinged doors, as well as other detachable covers shall be provided with heat resistant type neoprene rubber gaskets. The switchboard shall have IP 54 degree of protection.

The switchboard shall have an Earth Bus running the entire length of switchboard and shall have provision of extending the same on either side in future. The earth bus section shall be not less than 50 x 6 mm tinned copper with green colour identification. The overall height of the switchboard shall not exceed 2,400 mm.

The incoming MCCB (LT) shall have proper termination arrangement for connection of requisite nos. of 3.5 core or appropriate numbers of single core (AL) PVC armoured cable from bottom or top or busduct at the top as per requirement.

The switchboard shall be finished with powder coated paints (Siemens-Grey) after proper surface treatment by 7 tank process of cleaning. Switchboard shall be touched up after installation and commissioning at site as necessary.

Name plate, inscription plates and labels etc shall be on laminated white hylam plates of 3 mm thick and 12 mm high black engraved lettering to be screwed on the front door panel of all the feeder compartment as well as on the main panel. The panel markings shall be provided on the top with 100 mm laminated hytim plate and 75 mm letter size. Each side and openable back cover of cable and busbar chamber doors shall be provided with appropriate type of danger board.

2.1.6.4 Active Component Details

The active components to be housed in the switchboard shall be as follows:

2.1.6.5 Busbars and Connections
The busbars shall be extensible type of hard drawn high conductivity electrolytic grade tinned copper as specified with complete PVC sleeving except at the joints. Three busbars for phases and one busbar for neutral of adequate capacity shall be provided. Maximum current density of 1.50A/sq.mm for copper shall be considered. Mounting insulators shall be of DMC,SMC or equivalent type. The busbar supports shall be placed not more than 450 mm apart. (Technical data sheet of the insulation support shall be furnished by vendor). Minimum clearance between phase bars shall be 32 mm and between phase and earth shall be 25 mm. The busbars shall be properly insulated and colour coded. The construction of the switchboard shall be robust enough to withstand system fault of minimum 35 MVA.

2.1.6.6 Moulded case Circuit Breaker

The Moulded Case Circuit Breakers (MCCB) shall be used in the L.T switch board/Power Control Centre/Motor Control Centre wherever specified. These shall be having rupturing capacity not less than 15 KA at 415 V unless stated otherwise (CPRI tested). The MCCBs shall be either TP & N or 4 pole as specified in the tender schedule.

The MCCBs shall be provided with built in solid state adjustable type over current and earth fault releases with current setting range 70-100% for over current elements and 20-80% for earth fault with time delay setting element for the above.

The MCCBs shall be panel mounting type and shall be provided with operating handle fixed with the door frame for operation of the MCCB from the front of the panel with the cubicle door in closed position. The MCCB operating handle shall be door interlocking type with defeat mechanism and padlocking facility.

The MCCBs shall be provided with 2 NO + 2 NC auxiliary 240 V, 10A, AC change over contacts for control and indication purposes. Shunt trip or under voltage releases shall be also fitted and supplied with the MCCB as per requirement.

All the feeders specified with MCCBs shall be provided with ON/OFF indication lamps in front of the compartment door with suitable HRC type protective fuses wherever specified.
2.1.6.7 **Ammeters**

Ammeters shall be digital type and of reputed make, 96 mm sq. dial, 1.0 class accuracy.

All ammeters shall be 5 Amps CT operated unless specified otherwise and ammeter (3 nos) shall be provided.

2.1.6.8 **Current Transformer**

The current transformer shall be as follows:

i) Metering of specified rating and adequate VA burden accuracy class 1.0

ii) Protection CT of adequate VA burden and accuracy class 5P10 or compatible with various protective relays as specified.

2.1.6.9 **Voltmeters**

Voltmeters shall be digital type and of reputed make, 0-500V AC. 96 mm sq dial. 1.0 class accuracy. HRC fuses with fuse base and carriers shall be provided for voltmeter and phase indication lamps, wherever specified.

Each voltmeter shall be provided with voltmeter selector switch.

2.1.6.10 **Voltmeter Selector Switches**

These shall be of reputed make standard instrument switches permitting measurement of all the three line & phase voltages as necessary with an off position.

2.1.6.11 **Protective Relays, Releases etc**

The microprocessor solid state type releases for fault tripping of circuit breaker shall be provided as specified in drawing and shall be of same make. Each releases shall have suitable connection diagram affixed at the back of releases.

2.1.6.12 **Identification Labels**

All feeder Panels shall be provided with identification labels having 12 mm high black engraved lettering on 3 mm thick white laminate materials.

2.1.6.13 **Earth Busbar**
An earth bus of minimum size of 50 x 6 mm tinned copper with PVC sleevings shall be provided all along the length of the switch board. This shall be extensible on either side.

The earth bus of the switch board shall be suitable for connection with earth conductor at the place of installation at two points from the two sides of switchboard.

All metal stationary items of the panels shall be directly connected with the Earth Bus.

2.1.6.14 Cable compartments

Fully segregated cable compartment of adequate size shall be provided in the panels for easy termination of all incoming and outgoing cables entering from bottom or top. Adequate and proper supports shall be provided in cable compartments to support cables. All incoming and outgoing terminals shall be brought out to terminal blocks in the cable compartment.

2.1.6.15 Tests

The switch boards shall be accepted on the basis of routine and type/performance tests conducted as per latest issue of ISS/IES at manufacturer's premises, complete test reports shall be submitted to the Employer/Employer's representative before despatch of the switchboard.

2.1.6.16 Painting

All sheet metal parts (both inside and outside) of the switch board shall be given anti-corrosive treatment by seven tank process and powder coated finish of approved shade unless specified otherwise.

2.1.6.17 Guarantee

The switch board and all components shall be guaranteed for 18 months from the date of despatch or 12 calendar months from the date of commissioning and handing over whichever is later against defective design material and/or workmanship. The bidder shall be responsible for complete operation and routine as well as breakdown maintenance of the board including supply of all spares and consumables (except HRC fuses and lamps) during 1 year defect liability period. The cost of the same shall be included in the offer. No extra amount will be paid on this account.
2.1.6.2 Documents

The following drawings and documents as scheduled below shall be supplied by the bidder:

1. All detail GA, schematic SLD with terminal detail drawings shall be submitted with the tender in duplicate.
2. GA, Sectional diagram, foundation drawings, SLD and control schematic and terminal wiring diagram, etc in four(4) sets for comments/approval.
3. GA, Sectional diagram, foundation drawings, SLD and control schematic and terminal wiring diagram, etc “As Built” and the operation and maintenance manual in four(4) sets before submission of the final bill.

2.2 TECHNICAL SPECIFICATION FOR EARTHING INSTALLATION

The installation shall generally conform to IS 3043 - Indian Standard Code of Practice for Earthing, as amended upto date.

2.2.1 Earthing

a) Earthing Electrodes

The earthing electrode shall be either 0.6M x 0.6 M x 6.3 mm thick C.I plate as per IS:3043 or galvanised steel pipe of Class B medium quality - 50 mm (2") dia bore and 3.04 M (10') long as per requirement. A hole shall be provided at 100 mm (4") from the top end to receive a 13 mm (1/2") dia galvanised bolt and the bottom end shall be chisel cut for easy penetration into soil.

A suitable trench shall be excavated about 0.45 M (1'-6") deep and the pipe electrode are to be placed to an average depth of 3.35 M (11'-0") below ground level with requisite watering arrangement as per IS 3043. The top end of the electrode watering arrangement shall be at an average depth of 0.30 M (1') below the ground surface.

Two nos. 75 x 8mm or 50 x 6mm G.I. strip (unless otherwise specified) shall be connected securely on the properly cleaned surface at the top end of plater pipe electrode by means of a 100 mm (4") long x 13 mm (1/2") dia G.I. bolt nut and double washers as per IS. The earth lead conductor shall be protected mechanically by means of a continuous length of G.I. pipe.

2.2.2 Masonry Inspection Pit

The inspection pit for the earth station shall be approx 0.56 M x 0.56 M (1'-10"x1'-10") outside dimensions and approx 0.45 M (1'-6") deep when completed, having 5" thick
cement brick work with lst class bricks in cement mortar (6:1) both inside and outside plastered 19 mm (3/4") thick and neatly cemented 1.60 mm (1/16") thick, both inside, outside and top. The opening on top shall be provided with a C.I. ring with lockable cover fixed flush with ground surface.

All the excavations shall be duly back filled, dressed and rammed.

2.2.3 **Location for Earth Electrodes**

Electrodes shall be buried at least 2 M (6'-6") away from the building or object to be earthed.

Electrodes, when installed in parallel, shall not be placed less than 4 M (13'-2") apart and preferably placed at distances greater than twice their lengths satisfying the requirements of IS/IEC.

2.2.4 **Earth Busbar**

a) Galvanised M.S. Flat

The busbar shall be of suitable size and length, as specified in the Schedule of Items, heavily galvanised and having adequate number of drilled and tapped holes 30 mm apart, complete with G.I. bolts, nuts, washers for securely connecting the earth leads and earth continuity conductors. The busbar shall be fixed on wall, having clearance of 6 mm from wall with spacing insulators with at least the numbers 13 mm (1/2") G.I rag bolts spaced about 0.46 M (1'-6") apart. The details of earthing of substation equipment motors etc have been given in the respective technical specification.

2.2.5 **Value of Earth Resistance**

In case of installations where the load does not exceed 5 K.W. the resistance to earth shall on no account exceed 5 ohms. Where the load exceeds 5 K.W. the resistance shall not exceed 1 ohm.

For sub-station, etc the 415/240 V AC supply system shall be less than equivalent earthing grid resistance of one ohm. The 11 KV and 6.6 KV supply system shall have a minimum value of earth resistance less than one ohm for individuals earth stations and the equivalent combined earth resistance of the 11 KV and 6.6 KV system shall not be more than 0.50 (point five) ohms. The total number of earth stations shall be calculated on the basis of the actual value of the soil resistivity measured at site and to obtain the above equivalent earth resistance of the earthing grid or better and to satisfy ther specified fault
level. The bidder shall have to submit their calculation in support of their selection of number of earth stations required for each system and the selection of earthing strips required to satisfy the system requirement and meeting the requirements of IS/IEC specification.

2.3 ELECTRICAL WIRING

2.3.1 General Requirements

This specification covers the requirements of wiring in pump house and sub stations for lighting and power point installation work. The lighting installation shall be designed conforming to IS: 3646 and in accordance with the guide lines given in the National Electrical code (EC) and other similar standards.

2.3.2 Wires & Cables

All wires and cables to be used in electrical wiring shall have ISI marking on it. If the suppliers indicate that ISI marking on wires/cables is not possible because of manufacturing process, the cables/wires shall be accepted with the submission of test certificate and copy of licence issued by B.I.S. to the manufacturers.

2.3.3 Conduits

The conduits to be used in wiring shall conform to I.S 9537 (Part-II)-1981 or latest in all respects. The contractors using the particular brand of conduit shall furnish test certificate from N.T.H or any Government Approved Laboratory with each quantity of supply along with supply of conduits.

2.3.4 Materials

All materials, fittings, appliances, used in electrical installations, shall conform to Indian Standard Specifications wherever these exist. Only approved make of schedule materials shall be used. Materials not included in the list shall be got approved by the Employer / Employer’s representative prior to actual use.

2.3.5 Main Switch Gear

Iron clad switch fuse and isolator units should conform to IS:13947& IEC 60947. The quick make and break mechanism shall be self interlocked with the cover. In “Off” position there must be two breaks per pole.

Main switch gear shall be properly earthed with two numbers conductors if M.V and one number of L.V.

2.3.6 Busbar Chamber (B.B.C)
This shall be totally enclosed, metal clad type fabricated from rust proof 16 SWG sheet steel on angle iron frame and provided with sheet steel or cast iron detachable front cover and undrilled detachable end plates, suitable for mounting on wall or angle iron floor stand and painted with high quality enamel paint. G.I. bolts and nuts shall be used for assembly with suitable packing materials to ensure dust proof finish. Meters shall be provided on suitable sheet steel boxes. Switch shall be provided with cable end boxes as required.

The depth of B.B.C. shall be 150 mm (minimum). Minimum clearance of phase bars to earth shall be 25 mm and between bus bars shall be minimum 32 mm.

Copper bus bars conforming to relevant I.S. specification and shall not be more than the current density of 1000 Amps per sq.in./1.5 Amp. Sq.mm.

The cross section of the neutral busbar shall be the same as that of the phase busbar of capacity upto 200A and for higher capacity neutral busbars are to be rated to carry 60% of phase current. These shall be carried on glazed porcelain/DMC/SMC supports of proper dielectric and mechanical strength and shall be appropriately colour coded for identification of Phases, Neutral & Earth as per relevant IS Code.

Lettering shall be done for identification of switches as directed. The contractor shall submit fully dimensioned drawing of the board with the physical disposition of the switches and other components to the Employer’s representative for their approval before the same is fabricated.

There shall be two nos of Earth Terminals. Suitable Danger Board shall be provided.

### 2.3.7 Interconnection B.B.C, Switch Fuse, Meters, Etc

For ratings above 100 Amps these shall consist of insulated copper strips as per specification of adequate section. For rating below 100 Amps PVC copper cable tails of appropriate size, terminating in tinned copper sockets may be used. The above are to be enclosed either in sheet metal trunking or conduits so that no part is exposed.

### 2.3.8 Distribution Boards

These totally enclosed metal clad type Distribution Boards with hinged lids double door type and shall be in accordance with I.S. 2147 - 1952 and 2675 - l966. It shall be welded/bolted construction and fabricated from rust proof sheet steel and finished with anticorrosive powder coated paint and have provision for fixing on wall with earthing/terminals as per IS code.
Power Distribution Boards (400 volts TPN) shall be constructed from 16 SWG sheet steel and Branch Distribution Boards (230 volts SPN from 18 SWG sheet steel).

The minimum ratings of phase and neutral busbars shall be 67% (approx) of the total rating of fuse ways. Above 32 Amps Neutral Busbars may be half the size of the Phase Bus Bars.

The fuses shall be mounted on glazed porcelain DMC/SMC supports of proper dielectric & mechanical strength. TPN units should have phase separation barriers between fuse banks.

Cables shall be connected to a terminal by crimped lugs.

Where two or more B.D.B’s feeding low voltage circuits are fed from different phases of a medium voltage supply, these B.D.B’s shall be installed atleast two metres apart.

All three phase power distribution boards shall be properly earthed with two number 10 S.W.G galvanised iron wires and provided with suitable Danger Board. All SPN B.D.B’s shall be properly earthed with one number 10 SWG galvanised iron wire each unless otherwise specified.

2.3.9 Switches

All switches for lights, fans and plug points shall be either piono key type switches in sheet steel switch board, unless specified otherwise.

2.3.10 Cables and Conductors

All cables shall conform to relevant Indian Standard. Conductors of all cables except for flexible cables, shall be of aluminium, unless specified otherwise.

2.3.11 Flexible Cables

Conductors of flexible cables shall be of copper. The minimum size of core acceptable is 0.50 sq.mm (14/0.193 mm). The maximum weight to which the following twin flexible cords may be subjected are as follows :-

- Twin 16/0.20 mm : 3.3 lbs (1.5 kgs)
- Twin 23/0.0076 inch : 5.0 lbs (2.3 kgs)

2.3.12 Installation of Main Switch Board, BDB’s Mains, Submains, Distribution Wiring to Individual Points

The exact positions of all main switch board, BDB’s and all runs of mains and submains, and distribution wirings to individual points including the exact position of all light fittings
and switch boards shall be first marked on the buildings and shall be approved by the Employer / Employer’s representative before actual commencement of the work.

The D.Bs shall generally be installed at a height of 2.13 m (7 ft) from floor level.

2.3.13 Installation of Switch Boards

These shall be installed at a height of 1.5 mtrs (5'-0") and above the floor level.

2.3.14 Installation of Ceiling Fans

Unless otherwise specified all ceiling fans shall be hung not less than 2.75 M (9 ft) above floor. The suspension and clamp shall be painted with approved paint without involving extra cost.

2.3.15 Installation of CFL and Fluorescent Light Fittings

Luminaries: Integral type luminarie shall be used. BFL/Fluorescent lamp fittings are also to be fixed on the wall/ceiling in the specific areas as called for and given in the drawings. The positions are to be fixed as per requirement. The illumination level would be between 100-200 Lux in general areas. In the street and general outdoor areas are to be provided for maintaining 3-10 Lux average. Single or twin TL28 watt T5 cool day light type fluorescent. Lamp (rail/decorative type) fixtures and/or with suitable CFL lamp fixtures as specified shall be used in the general areas like offices, corridors, toilets and other similar areas as specified and indicated in the drawings.

The down rods and accessories shall be preferably GI or painted with approved paint without involving extra cost.

Unless otherwise specified these should be suspended 2.60 M (8'-6") above the floor.

2.3.16 Installation Of Exhaust Fans

Exhaust Fans shall be fitted by means of rag bolts embedded in the wall. The required holes in the wall shall be made and finished neatly with cement plaster and brought to the original finish of the wall.

2.3.17 Installation of Socket Outlets

No socket outlet shall be provided in the bath room at the height less than 130 cms (4'-3") from the floor.

No switches shall be provided inside the bath rooms.

Socket outlet at locations other than bath rooms shall be either 25 cms (10") or 1.5 mtrs (5'-0") from the floor as per requirement. All switch socket outlet shall be provided with one 6A or 16A controlling switch.
The completed work will be taken over only if the results obtained in above tests are within the limits mentioned above, and in accordance with I.E. Rules.

On completion of the installation work, a certificate shall be furnished by the contractor holding valid Electrical contractor licence, countersigned by the supervisor under whose direct supervision the installation was carried out. The supervisor counter signing the test result shall have valid supervisory licence from the Authority. This certificate shall be in a prescribed form as required by the local Electric Supply Authority. The installation shall not be considered as complete unless the installation is got inspected and passed by the Electrical Inspector, Directorate of Electricity.

The contractor shall have to take all initiatives and follow up the matter at his own cost for early approval of the installation for permanent energisation of the installation from the Directorate of Electrical Safety, Local supply Authority. No extra amount will be paid on this account.

2.4 Conduit Wiring System

2.4.1 Type and Size of Conduit

All conduit pipe shall be heavy duty GI and/or PVC conduit conforming to IS: 9537 with wall thickness not less than 2mm thickness conforming relevant IS in all respects. The conduits are to be free from burrs and internal roughness. No conduits less than 20 mm in dia shall be used, unless specified.

2.4.2 Accessories

Only good quality approved accessories are to be used when necessary.

All metal accessories shall be either GI or painted as per requirement and the bare thread portion is to be painted with anti-corrosive preservative.

2.4.3 Fixing of Conduits

Conduit pipes shall be fixed by heavy gauge saddles of GI for GI conduits and PVC for PVC conduits with h.w. or synthetic type fasteners, secured to wall/ceiling by screws driven into wood plugs or rawl plugs or philplugs at an interval of not more than 76 cm apart for vertical run and 50 cm apart for horizontal run; but on other side of couplers or bend of similar fittings-saddle shall be fixed at a distance of 30 cm from the centre of such fittings. The minimum thickness for saddles shall be 24 SWG, for conduits upto 25 mm dia and 20 SWG for larger sizes.
2.4.4 Outlets

All outlets for fittings, switches etc. shall be fixed on boxes of suitable metal for either surface mounting system or flush mounting system. All boxes shall be welded mild steel sheet box the wall thickness shall not be less than 16 gauge. Except where otherwise stated 3 mm thick insulated laminated sheets shall be fixed on the front with screws. Where conduits are terminated special care shall be taken for securely fixing conduits to outlets so as to prevent any possibility of damages to cables / wires when drawn.

2.4.5 Wires to be Used

Unless stated otherwise only single core PVC/XLPE insulated wires of approved manufactures shall be used for wiring in conduit system. The number of single core wires drawn in one conduit shall not be greater than maximum set out in Table II of Indian Standard (I.S. 732-1963) Code of Practice (revised) for electrical wiring installation(system voltage not exceeding 650 volts).

2.4.5 Capacity of Conduits

Maximum capacity of conduits for drawing in of PVC insulated wires shall be as follows:

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<thead>
<tr>
<th>650/ 1100 V PVC</th>
<th>in 20 mm dia</th>
<th>in 25 mm dia</th>
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<tbody>
<tr>
<td>copper wire</td>
<td>conduit</td>
<td>conduit</td>
</tr>
<tr>
<td>1.5 sq.mm</td>
<td>4 Nos</td>
<td>8 Nos</td>
</tr>
<tr>
<td>2.5 sq.mm</td>
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<td>-</td>
<td>4 Nos</td>
</tr>
<tr>
<td>16 sq.mm</td>
<td>-</td>
<td>2 Nos</td>
</tr>
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</table>

2.4.6 Looping-In-System

Distribution wiring in conduit to light, points etc. shall be done in looping system. In this system no joints or connections shall be made anywhere of the system except at terminating points such as at terminals of switches, ceiling roses, etc.

2.4.7 Earthing Continuity Wires

For conduits and accessories for distribution wiring should be provided with earthing attachment by one number 14 SWG G.I. wire, or 1.5 sq mm copper wires unless specified otherwise.
For looping earthing G.I. wire shall be run on conduits being fixed with saddles. This wire shall not be normally visible after installation when run with the conduit. Where the wire has to be taken without the conduits this will be fixed with 'U' nails at 2' feet intervals.

2.4.8 Painting

Conduit and all conduit fittings and accessories shall be painted with two coats matt paint. Painting of conduits shall be done to harmonize with colour bearing surface, i.e. wall, joists, trusses etc. after installation and as approved by the Employer / Employer’s representative.

2.5 Cable Installations

2.5.1 General

All PVC insulated and unarmoured / armoured cables to be used shall conform to I.S. 1554 part I 1964 and of 1100 volt grade. Old and used cables must not be used for installation. Only one make of cable shall be used. All cables brought to site must be tested and got approved by the Employer / Employer’s representative before these can be laid. The cables shall be despatched to site on wooden drums with ends sealed. Exact lengths shall be determined by the Contractor after measurement at site.

2.5.2 Laying of Cables

a) Direct in Ground

Trenches shall be 750 mm deep (minimum) for LT Cables and 0.915 M (3'-0") deep minimum) for HT Cables from ground level and trenching work shall include all pumping and bailing out water. These trenches shall be wide enough to accommodate all the cables with brick separations as per the requirements specified in the relevant I.S.

When more than one multicore cable is to be laid in the same trench, a minimum horizontal interaxial spacing between cables will be as per relevant I.S.

After excavation of the trench of proper size, the bottom of the trench shall be dressed and levelled and filled with a 75 mm layer of fine sand. The cable shall then be laid with bricks on both sides of the cable continuously. After having the space within the bricks, filled and packed upto a level of 75 mm (3") above top of cable with fine sand, the top layer of bricks shall be placed side by side in continuous series as protective cover. Total No. of bricks required being 16 per metre run. The remainder of the trench shall be filled with riddled soil, well rammed and watered to a level of 75 mm (3") above surrounding ground level.
The ground level surface of the whole trench route shall be restored properly after completion of cable laying.

b) **Inside Building**

Cables shall be laid on walls/ceiling/structure, unless specified otherwise, with M.S. brackets and suitable clamps or over claw type aluminium cleats fixed on M.S. brackets, spaced not more than 450 mm apart. G.I Bolts of suitable sizes are to be grouted on the wall properly for fixing the brackets.

c) Minimum bending radius permissible is 12D for PVC Armoured Cables and 15D for HT XLPE Armoured cables. At joints and terminations, the individual core of multicore cables should never be bent so that the radius is less than 12 times the diameter over the insulation for L.T. cables and 15 D for H.T cables.

2.5.3 **Cable Jointing**

All cable joints shall be carried out by experienced and Licenced jointers under strict supervision. Electro plated brass cable glands, aluminium / tinned copper cable sockets and approved jointing materials must be used. The price for cable jointing and finishing the ends of the cable shall include all materials and shall also provide for tools and plants for the work. The cable armouring is to be properly terminated. All cable accessories and other associated materials shall conform to Indian Standard Specification where applicable. Proper earthing of cable glands and armoured shall be included in the job.

2.5.4 **Testing of Cables**

Immediately after the initial laying and jointing work is completed, a pressure test shall be applied to all cables. Cables of 1.1 KV grade suitable for use on medium voltage should withstand for one minute a test with a 1000 volt constant pressure “Megger” Insulation Tester. If the test is unsatisfactory, the cost of all repairs and replacements and all extra work of removal and relaying will be made good by the contractor.

2.6 **Testing of Installation**

Before the completed installation is put into service or handed over to Employer, the installation is to be subjected to the above tests to the satisfaction of the Employer / Employer's representative. The completed work will be taken over only if the results are acceptable to the Employer / Employer's representative.

2.7 **L.C. Installation**
2.7.1 Specifications:

The installation shall conform to I.S. : 2309 – 1969 as amended up to date.

2.7.1.1 Conductor for L.C. System

It shall be well galvanized No. 25X6 MM G.I. strip conforming to IS unless specified otherwise. The conductor shall be well annealed and flexible. There shall be no joints in any conductor between ends.

2.7.1.2 Air Terminals

Air Terminal shall be single prong type constructed of 25 mm N.B (Class – B) medium quality G.I Pipe 1.5M long with a screwed GI solid conical cap 100 mm long (overall) on top and shall have a screwed galvanized M S flange 75 mm dia x 6 mm thick at bottom end and shall be grouted on the parapet, roof, etc with rag bolts in cement mortar unless specified otherwise.

2.7.1.3 Horizontal Conductors on Parapet

The conductors shall be coursed along ridges, parapets, edges of the flat roof, over flat roof where necessary in such a way as to joint each air terminals to the rest. The conductors shall be fixed securely with proper saddles spaced not more than 2 ft (0.6 M) apart.

2.7.1.4 Vertical Down Conductors

These conductors, direct from test point shall be connected to parapet conductors or air terminals and shall be coursed through shortest possible routes without abrupt turns or kinks. While passing through cornices, these shall pass through G.I pipe (Class B) having adequate bore. These conductor shall be fixed securely with proper saddles spaced not more than 2 ft. (0.6 M) apart.

2.7.1.5 Protection Against Damage and Corrosion

No upturns are permitted and any bend necessary shall have a permissible radius. The end of G.I pipe protections on wall shall be properly sealed with bitumen compound to prevent corrosion.

2.7.1.6 Metallic Objects near conductors

The conductors shall be so laid as to maintain a separation distance exceeding 2 meters (6’ – 6”) between (a) any electric conductor running in parallel, (b) metallic objects, viz. iron girders, water tanks, iron stair case, water / gas pipes inside or by the side of the building.
All the external metallic objects viz. water tanks, gutters, rain water down pipes, water mains, etc. shall be bonded to the nearest conductor by means of a short tail.

2.7.1.7 Joints & Bonds

All joints between conductors shall be made after cleaning and tinning the ends of conductors to be joined, binding them together for about 100 mm (4") with No. 14 SWG G.I wire and then welding.

Joint between Air Terminals and conductors shall be made with proper lugs duly fixed to conductors and bolts, nuts, washers etc.

Bonding shall be as short as possible. All joints and Bends are to be mechanically and electrically sound.

2.7.1.8 Earth Stations

Similar to Installation earths as specified elsewhere. Minimum number of earth station is two.

2.7.1.9 Installation Tests

After completion of works the ohmic resistance of L.C. installation complete with air terminals (without earth connection) shall be measured from the highest point and this shall be a fraction of one ohm.

The resistance to earth of individual earth stations shall be tested by earth testing megger and must not exceed 1.0 ohms and the combined overall resistance of the system shall be within 0.5 ohms

The above tests shall be made in the presence of the Employer / Employer’s representative and the results recorded.

2.7.1.10 Working and Completion Drawings

The bidder have to prepare and submit the detail schematic drawing with supporting calculations of the LC installation before proceeding with the work for approval. Works shall be carried out on the basis of the approved drawings. The contractor shall have to submit the “As built “ drawings before submission of the final bill.

3.0 Special Specifications

a) Illumination level for the pump house indoor areas shall be designed on the basis of IS : 3646 with average minimum illumination level of 150 lux in the General areas. The outdoor areas shall be provided with an average illumination level of 3 – 10 lux average.
b) Before fixing all switches, fittings etc. should be produced before Employer / Employer’s representative and get approved.

c) All metal switch boards and switch/regulator boxes to be used in work shall be painted with two coats of anti rust primer (red oxide paint) prior to erection. After erection they shall be again painted with two coats of enamel paint of approved quality.

d) Before execution of any portion of conduit work for wiring a neat proper layout should be made out by the contractor and got approved from the Employer / Employer’s representative. For this purpose contractor is advised to get acquainted with the layout drawings of the Employer’s representative.

e) While laying the conduits for concealed wiring in the ceiling or in the beams & columns and before casting the contractor must ensure that all the inlets and both ends of the conduits are plugged by means of dead end socket so that no foreign matter can enter the conduits and choke them.

f) Damage to any fitting during erection and before handing over the installation by contractor shall be set right or replaced by the contractor at his own cost.

g) Caution Board of proper size wherever required, shall be provided, as per I.E.E. regulations for which no extra payment will be admissible.

h) Any damages made on wall shall be repaired and should match with the surrounding surface otherwise same will be got done through Building Contractor at the cost of the Electrical Contractor and the cost thereof shall be recovered from their dues.

i) Earthing Installation shall be done in the presence of Employer’s representative.

j) The installations should not be energized without adequate earthing.

k) The I.C. switches and Distribution Boards shall be provided with neat lettering in block letters with paint for identification of the I.C. switches and for the points connected to each fuse way of the D.B’s for which no extra payment will be admissible.

4.0 Completion Drawings

The contractor shall be required to submit along with Final bill, the under-noted drawings on CD, along with three copies of Ammonia print each.

1. Plan (as per site layout drawing) of each floor (not less than 1:100 metric scale) showing :-
i) Location of Main Switch Board, Distribution boards (with the circuit numbers controlled by them).

ii) The runs of mains and submains.

iii) Location of lights, fans, wall brackets/ fittings and, other power consuming devices together with type of fittings and fixtures including circuit numbers.

iv) Position of Lightning Conductors and route of running conductor.

v) Position of Earthing Stations for light and power and Lightning Conductor Installation.

vi) and giving the following informations on the plans –

   a) Name of work with job no. Accepted Tender No.

   b) Date of completion

   c) Name of Place

   d) Name and Signature of Contractor

   e) Scale of Drawings.

2. Schematic lines layout diagram of each floor showing (i) Layout and connections of Main and Sub-board, B.D.B. having descriptions of the size, capacity, type and their numbers, the system and the source of supply, (ii) Location, Size, Type, length of main and sub main cables (iii) Loading of each B.D.B. indication of phases, Departmental mark on each B.D.B and switchgear.

   The drawings shall be very neatly drawn and submitted properly without folding them.

3. Cable route should be marked on site plan with measurements from permanent structures.

5.0 INSTALLATION TESTING & COMMISSIONING

5.1 Scope

The specification covers the requirements of installation, testing and commissioning of Indoor and outdoor equipments and shall be located in the rooms marked in building and feed power supply to the various loads. The works are to be carried out in accordance with the drawings, bill of quantities/schedule of items to which this specification has been referred to and together with any other specification/instructions given to the contractor. Detailed working/installation drawings shall have to be prepared by the contractor and work shall be executed as per the approved drawings.
5.2 Civil Engineering Work

All civil works such as making of foundations, pockets for bolts for grouting the equipments, cutting of floors, walls for the passage of cables, earth strips etc including insertion of suitable sized GI pipes M.S Channels etc., at such cutting/opening and filling and sealing of them etc are to be included in the present scope. All floors, ducts in buildings to be provided by the contractor and any other floor chasing / cutting required are to be made by the contractor and shall be filled up with sand or otherwise as approved and to an acceptable level after laying of cables and other materials and shall be as far as practicable flush with the floor. No extra claim due to this reason shall be considered and paid.

5.3 Testing and Commissioning

General procedure for testing and commissioning of panels shall be in accordance with good practice and relevant IS.

Commissioning checks and tests shall include in addition to checking of all small wiring connections, relays calibration and setting tests by secondary injection method or primary injection method. Primary injection test will be preferred for relay calibration and setting. Before the panel board is commissioned, provision of the safety items namely fire extinguishers, rubber mats and danger boards shall be ensured. In addition all routine/ meggar tests shall be performed. Checks and test shall include the following:

a) Operation checks and lubrication of all moving parts.

b) Interlock function checks.

c) Continuity checks of wiring, fuses etc as required.

d) Insulation tests.

e) Trip tests and protection gear tests,

f) Alarm annunciator indication check for different faults for incoming and outgoing feeders

g) The complete panel shall be tested with 5000 V megger for insulation between poles and poles to earth. Insulation test of secondaries of CTs and VT to earth shall be conducted using 500 V megger.

h) The trip supply battery unit (where provided) shall be checked after complete charging and the voltage measured.
i) Any other tests as may be required by the Licensee/Inspector shall be conducted.

j) Where specified, the entire switch board shall withstand second high voltage test after installation.

k) Any other test required by the Licensee/inspecting officer.

5.4 **Electrical Inspector’s Approval & Energisation**

The approval of the electrical installation, including Supply Authority tests and permission to switch on power supply shall be in the contractor’s scope of work without any extra charges. All substation layout drawings, single line diagrams, control schematic drawings and earthing installation drawings shall be prepared and submitted to the Electrical Authority and his approval shall be obtained. The contractor shall be totally responsible for obtaining approval (provisional and final) for execution and permanent energisation of the completed work and shall take all efforts for timely approval of the drawings and the completed installations for energisation.

All the necessary forms required by the Electrical Authorities are to be collected/arranged and to be properly filled up by the contractor. The contractor shall have to take all the initiatives/ responsibilities to get the completed installation inspected and passed by the Electricity Authority. Employer will only put their signature in the above application if required.

5.5 **Spares**

All consumables/spares required at the time of commissioning shall be supplied free of charge by the contractor.

The recommended spares for four (4) years routine maintenance after the 1 year Defect Liability Period shall be quoted for by the contractor and supplied when ordered by the Employer/Employer’s representative.

**LIST OF APPROVED MATERIALS**

The Contractor shall use materials in their works with prior approval of the Employer/Employer’s Representative of all materials, in accordance with the following list. Materials not specified hereunder shall be got approved by the Employer/Employer’s Representative before using the same in their work and nothing shall be used without the approval of the Employer/Employer’s Representative. All materials shall conform to the IS/IEC specifications as amended up to date.
wherever they exist. Otherwise the contractor shall have to prove that the materials offered by them are superior in design and quality and having proven performance and workmanship.

Only one make of materials/items shall be used for the similar items as per the choice of the Employer/Consultant and the materials shall be procured from the authorised stockiest/distributors only. Necessary manufacturer’s certificates shall be submitted for all the bought out items.

<table>
<thead>
<tr>
<th>Sl No.</th>
<th>Item</th>
<th>Make</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>LT Panels</td>
<td>Locally Fabricated using approved components and materials</td>
</tr>
<tr>
<td>2</td>
<td>MCCB</td>
<td>LT/SIEMENS/HEVELLS</td>
</tr>
<tr>
<td>3</td>
<td>Switch Fuse Unit(SFU)</td>
<td>LT/SIEMENS/HEVELLS</td>
</tr>
<tr>
<td>4</td>
<td>MCB DBs and their components</td>
<td>LT/SIEMENS/LEGRAND/HEVELLS</td>
</tr>
<tr>
<td>5</td>
<td>GI Conduits (medium class) and accessories</td>
<td>AKG/PRECISION/KALINGA/PLAZA</td>
</tr>
<tr>
<td>6</td>
<td>PVC Conduits/Casings (medium class) and accessories</td>
<td>AKG/PRECISION/KALINGA/PLAZA</td>
</tr>
<tr>
<td>7</td>
<td>PVC/XLPE insulated copper wires</td>
<td>RR KABEL/Finolex/National/Polycab/Havells</td>
</tr>
<tr>
<td>8</td>
<td>1.1KV AL/CU PVC/XLPE /A Cable</td>
<td>Polycab/CCI/Glostar</td>
</tr>
<tr>
<td>9</td>
<td>Light fittings</td>
<td>Philips/Crompton/Havells</td>
</tr>
<tr>
<td>10</td>
<td>Ceiling /Ex. Fan</td>
<td>Crompton/Orient/Bajaj/Havells</td>
</tr>
<tr>
<td>11</td>
<td>GI Protection Pipe (Medium Duty)</td>
<td>ITC/BST/Jindal</td>
</tr>
<tr>
<td>12</td>
<td>Paints</td>
<td>Shalimar/Jenson &amp; Nickelson/BERGER</td>
</tr>
</tbody>
</table>
Fig. 1: Close and Open Planking and Strutting

CLOSE PLANKING AND STRUTTING
WITH VERTICAL POLING BOARD

OPEN PLANKING AND STRUTTING

PLANKING AND STRUTTING
FOR SHALLOW-WIDE EXCAVATOR

POLING BOARD
250 MM RB

RAKE

BLOCKING

CLOSE PLANKING AND STRUTTING
WITH LONGITUDINAL POLING BOARD

SAWING NOT TO SCALE.
DIMENSIONS ARE IN MM.
Fig. 2: Arrangement of Ties and Spreaders
Fig. 3: Vee Bee Consistometer and Relationship between Slump in cm and the Degrees covered by the consistency scale
Fig. 4: Measurement of Small Voids

Area of Fig. 1A to 1E: Figure 1H and 1J would be A x B. Area of Figure 1F and 1G would be 1/2 A x Average of B and B'.
Fig. 5: Details of Typical Construction Joints
Fig. 6: Expansion Joints
Fig. 6 (contd): Expansion Joints
Fig. 7: Stone Masonry – Polygonal Rubble Uncoursed and Polygonal Rubble Brought to Courses
Fig. 8: Stone Masonry – Uncoursed Rubble/Random Rubble/Polygonal Rubble Masonry, Coursed Rubble Masonry, and Ashlar Masonry
Fig. 9: Stone Masonry
Fig. 10: Ashlar Stone Masonry

PLAIN

ELEVATION

Face joints to be not more than 3mm thick

PUNCHED (ORDINARY)

ELEVATION

BOND OR THROUGH STONE 1500 TO 1800 APART CLEAR

ODD COURSE

BOND OR THROUGH STONE 1000 TO 1200 APART CLEAR

ODD COURSE

EVEN COURSE

EVEN COURSE

DRAWING NOT TO SCALE
ALL DIMENSIONS ARE IN MM
Fig. 11: Brick Work - English Bond

- Brick work diagram showing English bond pattern
- Cross sections through various walls
- Plan of a brick wall
- Face bond changes on external angles
- No change in face bond
- Alternate courses of brick walls

English Bond

NOTE: All dimensions in millimetre
NOT TO SCALE
Fig. 12: Brick Drip Course and Joint of Roof with Wall

**Section at Ridge**

**Brick Drip Course And Joint of Roof With Wall**

**NOTE:** All dimensions in millimetre

*Fig. not to scale*
Fig. 13: 30 mm thick PVC Door Shutters
Fig. 14: PVC Door Frame
Fig. 15: 30 mm thick Panel PVC Door Shutter
FUNCTIONAL DIMENSIONS

Pattern-1

CONNECTING DIMENSIONS

Pattern-2

Dimensions in millimetres
### All dimensions in millimetres

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Description</th>
<th>Ref. in Fig.</th>
<th>Pattern 1</th>
<th>Pattern 2</th>
<th>Pattern 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>(i)</td>
<td>Height</td>
<td>A</td>
<td>360±10</td>
<td>360±10</td>
<td>360±10</td>
</tr>
<tr>
<td>(ii)</td>
<td>Depth of water seal, Min</td>
<td>H</td>
<td>80</td>
<td>80</td>
<td>80</td>
</tr>
<tr>
<td>(iii)</td>
<td>Width of water closet</td>
<td>J</td>
<td>360±10</td>
<td>360±10</td>
<td>360±10</td>
</tr>
<tr>
<td>(iv)</td>
<td>Distance from centre of seat bolt hole to front of water closet</td>
<td>K</td>
<td>415 to 445</td>
<td>415 to 445</td>
<td>415 to 445</td>
</tr>
<tr>
<td>(v)</td>
<td>Distance from centre of seat bolt hole to inside face of flush rim at back, Max</td>
<td>L</td>
<td>80</td>
<td>80</td>
<td>80</td>
</tr>
<tr>
<td>(vi)</td>
<td>Distance between a vertical line from tip of back plate to inside face of flush rim at back, Max</td>
<td>O</td>
<td>70</td>
<td>70</td>
<td>70</td>
</tr>
<tr>
<td>(vii)</td>
<td>Width of opening, Min</td>
<td>P</td>
<td>240</td>
<td>240</td>
<td>240</td>
</tr>
<tr>
<td>(viii)</td>
<td>Length of opening, Min</td>
<td>Q</td>
<td>230</td>
<td>230</td>
<td>230</td>
</tr>
<tr>
<td>(ix)</td>
<td>Overall length</td>
<td>S</td>
<td>500-5/5</td>
<td>500-5/5</td>
<td>500 Max</td>
</tr>
<tr>
<td>(x)</td>
<td>Trap inlet depth, Min</td>
<td>T</td>
<td>75</td>
<td>75</td>
<td>75</td>
</tr>
<tr>
<td>(xi)</td>
<td>Water surface Back to front</td>
<td>W₁</td>
<td>150 Min</td>
<td>100 Min</td>
<td>150 Min</td>
</tr>
<tr>
<td></td>
<td>Side to side</td>
<td>W₂</td>
<td>110 Min</td>
<td>75 Min</td>
<td>110 Min</td>
</tr>
</tbody>
</table>

Note: In case of centre vent in S Trap, overall length should be taken as S + 75.

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**FUNCTIONAL DIMENSIONS**

**CONNECTING DIMENSIONS**
Section 6 – Employer’s Requirements

Bidding Document for IDIPT (UK)  
Contract Package No: UK/IDIPT-III/ DDN/ 02
Location: General Offices Waste discharging in semicircular open channel and collected in floor trap.

Notes:
1. Slope: 1 in 10 to 1 in 50.
3. Waste Pipe: P.V.C. Flexible Type (52 mm)
4. F.T. Location preferred in Centre to Achieve Max. Slope.
5. Water supply connection not shown.

TYPICAL ELEVATION OF 3 WASH BASINS IN A ROW

TYPICAL DETAIL OF BOTTLE TRAP

Note: Stud shall be provided for supports intended for glazed earthenware, vitreousware wash basins only.

Drawing Not to Scale
All dimensions are in mm
Drawing Not to Scale
All dimensions are in mm
Section 6 – Employer's Requirements

Bidding Document for IDIPT (UK)  
Contract Package No: UK/IDIPT-III/ DDN/ 02
### Table 1: Dimensions of Seats and Covers

*All dimensions in millimetres.*

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Description</th>
<th>Dimensions</th>
</tr>
</thead>
<tbody>
<tr>
<td>(i)</td>
<td>Distance from centre line of hinge bolts to extreme edge of rim at front, A</td>
<td>445</td>
</tr>
<tr>
<td>(ii)</td>
<td>Length of opening at longest point, B</td>
<td>250</td>
</tr>
<tr>
<td>(iii)</td>
<td>Width of opening at widest point, C</td>
<td>215</td>
</tr>
<tr>
<td>(iv)</td>
<td>Overall width at widest point, D</td>
<td>380</td>
</tr>
<tr>
<td>(v)</td>
<td>Distance between inner and outer rims, E</td>
<td>56</td>
</tr>
<tr>
<td>(vi)</td>
<td>Centre-to-centre distance of seat bolt holes, F</td>
<td>145</td>
</tr>
<tr>
<td>(vii)</td>
<td>Distance from centre line of hinge bolts to inner rim of seat at the back, G</td>
<td>85</td>
</tr>
<tr>
<td>(viii)</td>
<td>Thickness of seat at thinnest point</td>
<td>3</td>
</tr>
<tr>
<td>(ix)</td>
<td>Thickness of cover at thinnest point</td>
<td>3</td>
</tr>
</tbody>
</table>

**Note:** Some hinging devices are made so as to provide adjustment in the longitudinal direction. This is not precluded by these figures.
Note: Where a closed channel with overflow is not provided a domed grating with perforating starting from the base and the crown of which shall be 25 mm, minimum above surface shall be provided which may be integral or otherwise.
**Note:** The clamps shall be made from 1.5 mm thick M.S. flat of 32 mm width, bent to the required shape and size to fit tightly on the socket, when tightened with nuts & bolts. It shall be formed of two semicircular pieces with flanged ends on both sides with holes to fit in the screws, bolts and nuts 40 mm long. The stay shall be minimum one metre long of 10 mm dia M.S. bar. One end of the stay shall be bent for embedding in the wall in cement concrete block of size 20 cm x 10 cm x
10 cm in 1:2:4 mix (1 cement : 2 coarse sand : 4 graded stone aggregate 20 mm nominal size). The concrete shall be finished to match with the surrounding surface.

### Dimensions

| Nominal Sizes | A | B | C | D | E | F | G | H | J | K | L | M | N | O | P | Q | R | S | T | U | V | W |
| 6             | 47.8 | 13.3 | 7.8 | 16.5 | 6.3 | 2.9 | 7.9 | 7.8 | 3.9 | 10.0 | M20 | 1.5 | 14.3 | 2.8 | 6.6 | 2.4 | 11.0 | 4.7 | 1.6 | 15.2 | 19.5 | 7 | 3.5 |
| 10            | 54.0 | 14.0 | 9.4 | 18.7 | 7.5 | 2.0 | 9.5 | 9.5 | 4.7 | 11.5 | M20 x 1.5 | 15.9 | 3.2 | 9.0 | 3.2 | 11.4 | 7.9 | 2.0 | 20.8 | 23.3 | 7 | 4 |
| 15            | 54.0 | 14.0 | 9.4 | 18.7 | 7.5 | 2.0 | 9.5 | 11.0 | 5.6 | 11.5 | M24 x 1.5 | 19.0 | 3.2 | 13.0 | 4.1 | 15.0 | 9.5 | 2.0 | 25.6 | 28.3 | 9 | 4.5 |
| 20            | 66.4 | 15.7 | 10.9 | 21.1 | 8.9 | 2.5 | 11.1 | 12.5 | 6.4 | 13.5 | M30 x 1.5 | 25.4 | 4.0 | 16.0 | 4.9 | 16.3 | 10.3 | 2.0 | 30.5 | 33.0 | 10.5 | 6 |
| 25            | 66.8 | 18.0 | 12.5 | 23.0 | 10.1 | 2.5 | 12.7 | 13.0 | 7.1 | 17.0 | M35 x 1.5 | 33.3 | 4.0 | 23.0 | 4.9 | 19.1 | 11.0 | 2.9 | 37.5 | 42.4 | 11.5 | 7 |
| 32            | 74.6 | 22.5 | 14.1 | 30.9 | 13.7 | 2.5 | 14.3 | 16.0 | 7.8 | 19.0 | M48 x 1.5 | 40.1 | 4.3 | 39.0 | 5.9 | 21.4 | 12.7 | 3.2 | 47.2 | 52.1 | 13.5 | 9.5 |
| 40            | 82.5 | 25.0 | 15.7 | 33.3 | 15.7 | 2.5 | 15.9 | 17.5 | 8.6 | 20.5 | M56 x 1.5 | 47.7 | 5.5 | 36.0 | 5.9 | 21.4 | 14.3 | 3.2 | 56.4 | 56.5 | 13.5 | 11 |
| 50            | 90.0 | 25.0 | 15.7 | 33.3 | 15.7 | 2.5 | 17.4 | 17.5 | 12.5 | 25.0 | M72 x 1.5 | 65.5 | 6.3 | 46.0 | 8.3 | 25.1 | 15.9 | 4.0 | 70.1 | 71.5 | 16.5 | 14.5 |

**Note 1:** Length of thread R includes cut back under hexagon, if any.

**Note 2:** The values of K are for core diameter.

**Note 3:** The diameter of U and V are for face to face.

**Note 4:** The dimension F is packing space.
Drawing Not to Scale
All Dimensions are in mm
Fig. : Typical Connection Diagram from SDB to Room Switch Board
Fig. 54: Schematic Line Diagram of Pre-wired MCB Distribution Boards (Single Phase)

Pre-wired MCB distribution boards
(Single Phase)

Schematic Line Diagram
Not to Scale

Fig.: 12
Clause: 8.4.1.1

Method of Plate Earthing

G.A. LEVEL

C.I. COVER HINGED TO C.I. FRAME

FUnnel

WIRE MESH

BRICK Masonary

20mm G.I. PIPE FOR WATERING

EARTH ELECTRODE FOR EARTH CONNECTION IN G.I. PIPE

G.I. PIPE FOR PROTECTION

WIRE/STRIP CONNECTION

ALTERNATE LAYER OF CHARCOAL/ COKE OR SALT

15 Mtr.

60cm x 60cm, 6mm. G.I. Plate

60cm x 60cm, 3mm. Copper Plate

"A"

NOTE:
BOLTS, NUTS, CHECK NUT AND WASHERS TO BE OF G.I. FOR G.I. PLATE AND OF TWISTED BRASS FOR COPPER PLATE

ALL DIMENSIONS ARE IN CM. (OTHER DIMENSIONS SHOWN)
EARTHING CONCEPT

1, 2, 3, 4 = Protective conductors
1. = Circuit Protective conductors
2. = Main equipotential bonding conductor
3. = Earthing conductor
4. = Supplementary equipotential bonding conductor (where required)
B = Main earthing terminal
M = Exposed conductive part
C = Extraneous conductive part
P = Main metallic water pipe
T. = Earth electrodes (TT & IT system)
E = Other means of earthing (TN system)
Fig. : Typical Earthing Schematic for Internal Electrical Installation

TYPICAL EARTHING SCHEMATIC FOR INTERNAL E.I.

1. Earth electrode
2. Earthing conductor
3. Protection pipe earthing conductor
4. Main earthing terminal or earth bus
5. Earth bus
6. Earthing terminal
7. Extra protective parts
8. Protective conductor
9. Protective (loop earthing) conductor
10. Main bonding conductor
11. Supplementary bonding conductor
12. Independent earth connection block

NOTE 1. (8) Should be terminated to (11) by screws.
2. Earth pin of socket outlet and metal pipe part of fan regulators should be connected to * in switch boxes.
3. Fillings with earthing terminals may be connected to * in metal boxes.
4. When distribution is by U.G. cable protective conductors should be provided in addition to the cable armoring.
5. All earthing terminals & earth bus shall be marked as (E) or . The main earthing terminal shall be marked as SAFETY EARTH: DO NOT DISCONNECT.
Supplementary Information

Third Party Inspection and Testing

64.1 Contractor shall submit Quality assurance plan for Project Manager’s approval.

64.2 Any agency among the agencies appointed or authorized by the Employer will undertake Independent third party inspections and testing for supply of material for works and/ or any Executed works. 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.

64.3 The Employer or Project Manager or his authorized representative or authorized agency may make inspections at any of the manufacturing or shipping points at any time in addition to the schedule provided in the specification at the cost of Employer. However, during such inspection, if it is found that any of the items are not being manufactured or shipped in accordance with the specifications, the contractor shall bear all expenses including fees incurred by the employer in respect of such inspection.

64.4 If as a result of the inspection or testing referred to in this Clause, the Project Manager 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 accordingly. The Contractor shall then promptly make good the defect or replace the same. 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 contractor and may be deducted from any money’s due that the Contractor and the Project Manager shall notify the Contractor accordingly.

64.5 Any inspection carried out by the Project Manager shall not relieve the contractor of his obligations under the contract.

Contractor’s General Responsibilities

66.1 The Contractor shall, with due care and diligence, design (to the extent provided for by the Contract), 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, required in and for such design, 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. 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.
66.2 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.

66.3 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.

66.4 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.

66.5 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.

66.6 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.
66.7 The Contractor shall establish site office for his staff and also make provision of space and furniture for Employer’s Representative at his own cost.

**Water for works and workforce, Electricity, Power, Fuel etc.**

67.1 The contractor at his own expenses should provide water from municipal mains or other sources for the use of work and workmen. The contractor shall be fully responsible to arrange such electricity, power, water, and fuel as may be necessary to complete the works and fulfill his obligations under the Contract. The unit rates and prices quoted by the Bidder in the Bill of Quantities shall include the cost of all electricity, power, water, and fuel as may be required.

**Site Office for the supervision for the work**

68. The Contractor shall at his own cost make available during the progress of the works and until the date of final completion thereof an Office in all respect suitable for the purpose of a Site Office for the Project Manager and its representatives, and a no less than 40 sqm, together with a laboratory as mentioned in Section 6 under Supplementary Information to be established by the Contractor. The office shall contain no less than sufficient number of tables, chairs, steel Almirahs, a sufficient number of display boards and toilet facilities. All such office, laboratory and other facilities shall be made available within 30 days from the date of commencement of work as per requirements and directions of the Project Manager, including maintenance of the same. The said office shall be removed from the site on the completion of the Work. All dismantled items of the Site Office and furniture items shall be the property of the Contractor at the completion of the work and its onward disposal shall remain the responsibility of the Contractor.
Supplementary Information
Regarding Works To Be Procured

6.5 Brief Description of Site of Contract Package

Kartikeya Swami Temple

Kartikeya Swami temple is only 40kms from Rudraprayag on Rudraprayag - Pokhari route. Kartikeya Swami temple is located near Kanak Chauri village on Rudraprayag – Pokhari route in the Rudraprayag district of Uttarakhand. A mild 3kms trek from Kanak Chauri village takes one to the stunning beauty of Kartikeya Swami temple. Some stretch of it passes through the Rhododendron forests with Himalayan scenic beauty.

Kartikeya Swami (Murugan swami as known in Southern India) Temple amidst serene environ of Himalayas. The shrine is dedicated to Lord Shiva’s son Kartikeya and is situated on a big rock atop the highest cliff around known locally as ‘Swaminath danda’ (Swaminath-Kartik swami, Danda-Mountain in Garhwali). It is at an altitude of 3050 m above the sea level, in Rudraprayag District of Himalayan state of Uttarakhand. This is only temple dedicated to lord Murugan or Kartikeya in Uttarakhand and one of only few in whole Northern India. There is a Bhairon temple just 100 meters before Kartikeya swami. According to Hindu mythology, Lord Shiva (the destroyer) told his sons Ganesha and Kartikeya that one of them, who will be the first to take seven rounds of the universe, will have the privilege of being worshiped first. Kartikeya Swami is worshiped by villagers of 360 villages.

Ganesha took seven rounds around Shiva and Parvati, while Kartikeya faithfully circled the universe. Impressed by Ganesha, Shiva gave him the honour of being worshipped before anyone. Angered by this, Kartikeya sacrificed his body and gave his bones to Lord Shiva as reverence. Chaukhamba peaks, Kedarnath peak are clearly visible from here.
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<th>DRAWING NAME</th>
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<td>PROPOSED MASTER PLAN AT KARTIKEY SWAMI</td>
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(UK/KAR/SITE/LAYOUT 02)
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(UK/KAR/SITE/LAYOUT 03)
PROPOSED PATHWAY DEVELOPMENT AT KARTIEY SWAMI
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PROPOSED PATHWAY DEVELOPMENT AT KARTIEY SWAMI
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PROPOSED PATHWAY DEVELOPMENT OF TEMPLE COMPLEX
AT KARTIEY SWAMI (UK/KAR/SITE/LAYOUT 07)
PROPOSED PLANE & ELEVATION & SECTION OF REST SHED
AT KARTIKEY SWAMI (UK/ARS/REST SHED 01)

GENERAL NOTES:
ALL DIMENSIONS AND LEVELS ARE IN HEOLOGRAMS UNLESS SPECIFIED. DRAWINGS SHALL NOT BE SCALDED, ONLY WRITTEN
DIMENSIONS SHALL BE FOLLOWED.
ALL DIMENSIONS GIVEN ARE FROM UNFINISHED TO UNFINISHED SURFACES.
ANY DUTY OR DISCONTINUITY IN THE DRAWING SHALL BE BROUGHT TO THE ATTENTION OF THE
ARCHITECT IN CHARGE BEFORE EXECUTING THE WORK.
THIS DRAWING SHALL BE READ IN CONJUNCTION WITH THE RELEVANT STRUCTURAL DRAWINGS ALONG
WITH RESPECTIVE DRAWINGS AND SPECIFICATIONS.
WORK SHALL BE CARRIED OUT BASED ON DETAIL WORKSHOP DRAWINGS.

PLAN X-X' AT LEVEL 1500mm SCALE 1:50
SECTION AT C-C' SCALE 1:50
ROOF PLAN SCALE 1:40
PROPOSED FOUNDATION DETAIL FOR REST SHED
AT KARTIKEY SWAMI (UK/ARS/REST SHED 02)
PROPOSED FLOOR PLANE OF VIEWING POINT
AT KARTIKEY SWAMI (UK/ARS/VIEW POINTS 01)
PROPOSED SECTION AND FOUNDATION OF VIEWING POINT AT KARTIKEY SWAMI (UK/ARS/VIEWS POINTS 02)

ELEVATION AT Y-Y'

SECTION AT X-X'

FOUNDATION DETAIL
PROPOSED FLOOR PLANE OF YATRI SHED
AT KARTIKEY SWAMI (UK/ARS/YATRI SHED 01)
PROPOSED SECTION AND FOUNDATION OF YATRI POINT
AT KARTIKEY SWAMI (UK/ARS/YATRI SHED 02)
PROPOSED PLANE & ELEVATION, SECTION OF TOILET BLOCK (TYPE B) AT KARTIKEY SWAMI (UK/ARS/TOILET (TYPE B) 01)
PROPOSED ROOF PLAN, TRENCH PLAN & FOUNDATION DETAIL OF TOILET BLOCKS AT KARTIKEY SWAMI (UK/ARS/ TOILET (TYPE B) 02)
PROPOSED PLANE, ELEVATION, SECTION OF ENTRANCE GATE AT KARTIKEY SWAMI (UK/ARS/ ENTRANCE GATE AT 01)
PROPOSED FOUNDATION DETAIL FOR ENTRANCE GATE AT KARTIKEY SWAMI (UK/ARS/ ENTRANCE GATE AT 02)
PROPOSED CENTER LINE, CILL/LINTEL LEVEL, WORKING PLANE OF TOILET BLOCK AT KARTIKAY SWAMI (UK/KAR/TOILET BLOCK (TYPE –A) 01)

CENTER LINE PLAN SCALE: 1:50

WORKING PLAN SCALE: 1:50

JOINERY SCHEDULE:

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<tr>
<th>C/W</th>
<th>Description</th>
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<th>Notes</th>
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<td>MDF</td>
<td>8' x 2'</td>
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<td>Door Panel</td>
<td>MDF</td>
<td>3' x 6'</td>
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<td>PVC</td>
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PROPOSED TRENCH PLANE, FOUNDATION PLAN FOUNDATION
DETAIL OF TOILET BLOCK AT KARTIKAY SWAMI (UK/KAR/TOILET BLOCK
(TYPE –A) 02)
PROPOSED ELEVATIONS AND SECTION OF TOILET AT KARTIKAY SWAMI
(UK/KAR/TOILET BLOCK (TYPE –A) 03)

GENERAL NOTES:
1. ALL CONSTRUCTION DETAILS SHOWN ARE FOR GUIDANCE ONLY.
2. DRAWING NO. UK/IDIPT-III/ DDN/ 02

1. Make of Equivalent: 4mm with S-100
2. Make of Equivalent: 4mm
3. Local Make

SECTION AT A-A' SCALE: 1:50
PROPOSED TRUSS DETAIL OF TOILET AT KARTIKAY SWAMI
(UK/KAR/TOILET BLOCK (TYPE –A) 05)
PROPOSED PLANE, ELEVATION AND SECTION OF EXISTING TEMPLE AT KARTIKAY SWAMI (UK/KAR/RENOVATION 01)
RENOVATION OF VYAS GUFA AT KARTIKAY SWAMI
(UK/KAR/RENOVATION 02)
PROPOSED RENOVATION OF EXISTING TOILET BLOCK AT KARTIKAY SWAMI (UK/KAR/RENOVATION 03)
PROPOSED RENOVATION OF EXISTING DHARAMSHALA AT KARTIKAY SWAMI (UK/KAR/RENOVATION 04)
PROPOSED RENOVATION AND CONSTRUCTION OF HUT AND DORMITORY AT KARTIKAY SWAMI (UK/KAR/RENOVATION 05)
PROPOSED RENOVATION OF POND AT KARTIKAY SWAMI
(UK/KAR/RENOVATION 06)
PROPOSED DEVELOPMENT OF CAMPING SITE AT KARTIKAY SWAMI (UK/KAR/CAMPING SITE 01)
PROPOSED DEVELOPMENT OF CAMPING SITE AT KARTIKAY SWAMI (UK/KAR/ CAMPING SITE 02)
PROPOSED PLAN ELEVATION & FOUNDATION DETAIL OF DIRECTIONAL DISPLAY BOARD ATKARTIKAY SWAMI (UK/KAR/INFORMATIVE DISPLAY & PUBLICITY 01)
PROPOSED PLAN ELEVATION OF INFORMATIVE DISPLAY & PUBLICITY AT KARTIKAY SWAMI (UK/KAR/INFORMATIVE DISPLAY & PUBLICITY 02)
PROPOSED TYPICAL DETAIL OF PEDESTRIAL PATHWAY AT KARTIKAY SWAMI (UK/KAR/ MISCELLANEOUS 01)

GENERAL NOTES:
All dimensions and levels are in millimeters unless specified.

ALL DIMENSIONS GIVEN ARE FROM UNFINISHED TO UNFINISHED SURFACE.

Any variation in thickness of the stone shall be brought to the notice of the architect in advance before executing the work.

THE DRAWING SHALL BE READ IN CONNECTION WITH OTHER STRUCTURAL DRAWINGS.

NOTE:
TOTAL LENGTH OF PATHWAY = 1200 MM.
PROPOSED RETAINING WALL AND BREAST WALL AT KARTIKEY SWAMI(UK/KAR/ MISCELLANEOUS 03)

NOTE:
LOCATION OF RETAINING WALL AND BREAST WALL MAY VARY AS PER EXISTING SITE CONDITION.
TOTAL LENGTH OF RETAINING WALL- 200 MTR.
TOTAL LENGTH OF BREAST WALL= 120 MTR.

RETAINING WALL SCALE: 1:20

BREAST WALL SCALE: 1:20
PROPOSED STONE BENCH AT KARTIKEY
SWAMI(UK/KAR/MISCELLANEOUS 04)

NOTE :- LOCATION OF STONE BENCH TO BE DECIDED AS PER SITE REQUIREMENT
PROPOSED ELECTRICAL LAYOUT AT KARTIKEY SWAMI (UK/KAR/ MISCELLANEOUS 05)
## Personnel Requirements

Using Form PER-1 and PER-2 in Section 4 (Bidding Forms), the Bidder must demonstrate it has personnel that meet the following requirements:

<table>
<thead>
<tr>
<th>No.</th>
<th>Position</th>
<th>Total Work Experience [years]</th>
<th>Experience In Similar Work [years]</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Project Manager (Civil Engineering Graduate)</td>
<td>15</td>
<td>10</td>
</tr>
<tr>
<td>2</td>
<td>Conservation Architect</td>
<td>10</td>
<td>7</td>
</tr>
<tr>
<td>3</td>
<td>Senior Site Engineer 1 (Civil Engineering Graduate)</td>
<td>15</td>
<td>10</td>
</tr>
<tr>
<td>4</td>
<td>Site Engineer 2 (Diploma in Civil Engineering)</td>
<td>10</td>
<td>7</td>
</tr>
<tr>
<td>5</td>
<td>Site Engineer 1 (Diploma in Electrical Engineering)</td>
<td>10</td>
<td>5</td>
</tr>
</tbody>
</table>
## Equipment Requirements

Using Form EQU in Section 4 (Bidding Forms), the Bidder must demonstrate it has the key equipment listed below:

<table>
<thead>
<tr>
<th>No.</th>
<th>Equipment Type and Characteristics</th>
<th>Minimum Number Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Concrete Mixers Portable One</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>Needle Vibrators (mix sizes)</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>Plate Vibrator</td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td>Water tanker</td>
<td>2</td>
</tr>
</tbody>
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Section 7 - General Conditions of Contract

Uttarakhand Tourism Development Board (UTDB),
Department of Tourism, Government of Uttarakhand

[Name of Employer]

Development of Tourism Infrastructure in Kartikeya Swami Circuit - Kartikeya Swami Temple

[Name of Contract]
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General 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 29.1 [Appointment of Adjudicator] hereunder.

(d) **Bank** means the financing institutions named in the PCC.

(e) **Bill of Quantities** means the priced and completed Bill of Quantities forming part of the Bid.

(f) **Compensation Events** are those defined in GCC 51.1 hereunder.

(g) The **Completion Date** is the date of completion of the Works as certified by the Project Manager, in accordance with GCC 69.1 [Completion].

(h) 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.

(i) The **Contractor** is the party whose Bid to carry out the Works has been accepted by the Employer.

(j) The **Contractor’s Bid** is the completed bidding document submitted by the Contractor to the Employer.

(k) The **Contract Price** is the Accepted Contract Amount stated in the Letter of Acceptance and thereafter as adjusted in accordance with the Contract.

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

(m) **Dayworks** 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.

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

(o) The **Defects Liability Certificate** is the certificate issued by Project Manager upon correction of defects by the Contractor.

(p) The **Defects Liability Period** is the period calculated from the Completion Date where the Contractor remains responsible for
remediating defects.

(q) **Drawings** include calculations and other information provided or approved by the Project Manager for the execution of the Contract.

(r) The **Employer** is the party who employs the Contractor to carry out the Works, as specified in the **PCC**.

(s) **Equipment** is the Contractor’s machinery and vehicles brought temporarily to the Site to construct the Works.

(t) **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.

(u) **In writing** or **written** means hand-written, type-written, printed or electronically made, and resulting in a permanent record.

(v) The **Initial Contract Price** is the Contract Price listed in the Employer’s Letter of Acceptance.

(w) 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.

(x) **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.

(y) **Materials** are all supplies, including consumables, used by the Contractor for incorporation in the Works.

(z) “**Party**” means the Employer or the Contractor, as the context requires.

(aa) **PCC** means Particular Conditions of Contract

(bb) **Plant** is any integral part of the Works that shall have a mechanical, electrical, chemical, or biological function.

(cc) 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.

(dd) **Retention Money** means the aggregate of all monies retained by the Employer pursuant to GCC 55.1 [Retention].

(ee) **Schedules** means the document(s) entitled schedules, completed by the Contractor and submitted with the Letter of Tender, as included in the Contract. Such document may include the Bill of Quantities, data, lists, and schedules of rates and/or prices.

(ff) The **Site** is the area defined as such in the **PCC**.
(gg) **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.

(hh) **Specification** means the Specification of the Works included in the Contract and any modification or addition made or approved by the Project Manager.

(ii) 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.

(jj) 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.

(kk) **Temporary Works** are works designed, constructed, installed, and removed by the Contractor that are needed for construction or installation of the Works.

(ll) A **Variation** is an instruction given by the Project Manager which varies the Works.

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

---

**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) Contract Agreement,
(b) Letter of Acceptance,
(c) Letters of Technical Bid and Price Bid,
(d) Particular Conditions of Contract,
(e) the List of Eligible Countries that was specified in Section 5 of the bidding document,
(f) General Conditions of Contract,
(g) Specifications,
(h) Drawings,
(i) Completed Activity Schedules or Bill of Quantities, and
(j) 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.

3.2 Throughout the execution of the Contract, the Contractor shall comply with the import of goods and services prohibitions in the Employer’s country when

1. (a) by an act of compliance with a decision of the United Nations Security Council taken under Chapter VII of the Charter of the United Nations, the Borrower’s Country prohibits any import of goods from, or any payments to, a particular country, person, or entity. Where the borrower’s country prohibits payments to a particular firm or for particular goods by such an act of compliance, that firm may be excluded.

4. Contract Agreement

4.1 The Parties shall enter into a Contract Agreement within 28 days after the Contractor receives the Letter of Acceptance, unless the Particular Conditions establish otherwise. The Contract Agreement shall be based upon the attached Contract forms in Section 8. The costs of stamp duties and similar charges (if any) imposed by law in connection with entry into the Contract Agreement shall be borne by the Employer.

5. Assignment

5.1 Neither Party shall assign the whole or any part of the Contract or any benefit or interest in or under the Contract. However, either Party:

(a) may assign the whole or any part with the prior agreement of the other Party, at the sole discretion of such other Party, and

(b) may, as security in favor of a bank or financial institution, assign its right to any moneys due, or to become due, under the Contract.

6. Care and Supply of Documents

6.1 The Specification and Drawings shall be in the custody and care of the Employer. Unless otherwise stated in the Contract, two copies of the Contract and of each subsequent Drawing shall be supplied to the Contractor, who may make or request further copies at the cost of the Contractor.

6.2 Each of the Contractor’s Documents shall be in the custody and care of the Contractor, unless and until taken over by the Employer. Unless otherwise stated in the Contract, the Contractor shall supply to the Engineer six copies of each of the Contractor’s Documents.

6.3 The Contractor shall keep, on the Site, a copy of the Contract, publications named in the Specification, the Contractor’s Documents (if any), the Drawings and Variations and other communications given under the Contract. The Employer’s Personnel shall have the right of access to all these documents at all reasonable times.

6.4 If a Party becomes aware of an error or defect in a document which was prepared for use in executing the Works, the Party shall promptly give notice to the other Party of such error or defect.

7. Confidential Details

7.1 The Contractor’s and the Employer’s Personnel shall disclose all such confidential and other information as may be reasonably required in order to verify the Contractor’s compliance with the Contract and allow its proper implementation.
7.2 Each of them shall treat the details of the Contract as private and confidential, except to the extent necessary to carry out their respective obligations under the Contract or to comply with applicable Laws. Each of them shall not publish or disclose any particulars of the Works prepared by the other Party without the previous agreement of the other Party. However, the Contractor shall be permitted to disclose any publicly available information, or information otherwise required to establish his qualifications to compete for other projects.

7.3 Notwithstanding the above, the Contractor may furnish to its Subcontractor(s) such documents, data and other information it receives from the Employer to the extent required for the Subcontractor(s) to perform its work under the Contract, in which event the Contractor shall obtain from such Subcontractor(s) an undertaking of confidentiality similar to that imposed on the Contractor under this Clause.

8. Compliance with Laws

8.1 The Contractor shall, in performing the Contract, comply with applicable Laws.

8.2 Unless otherwise stated in the Particular Conditions:

(a) the Employer shall acquire and pay for all permits, approvals and/or licenses from all local, state or national government authorities or public service undertakings in the Employer's Country; country where the Site is located] which (i) such authorities or undertakings require the Employer to obtain in the Employer's name, and (ii) are necessary for the execution of the Contract, including those required for the performance by both the Contractor and the Employer of their respective obligations under the Contract;

(b) the Contractor shall acquire and pay for all permits, approvals and/or licenses from all local, state or national government authorities or public service undertakings in the […]Employer's Country or country where the Site is located] which such authorities or undertakings require the Contractor to obtain in its name and which are necessary for the performance of the Contract, including, without limitation, visas for the Contractor's and Subcontractor's personnel and entry permits for all imported Contractor's Equipment. The Contractor shall acquire all other permits, approvals and/or licenses that are not the responsibility of the Employer under Sub-Clause 8.2(a) hereof and that are necessary for the performance of the Contract. The Contractor shall indemnify and hold harmless the Employer from and against any and all liabilities, damages, claims, fines, penalties and expenses of whatever nature arising or resulting from the violation of such laws by the Employer or its personnel, including the Subcontractors and their personnel, but without prejudice to Sub-Clause 8.1 hereof.

9. Joint and Several Liability

9.1 If the Contractor is a joint venture, consortium, or association (JVCA) of two or more persons, all such persons shall be jointly and severally liable to the Employer for the fulfillment of the provisions of the Contract, unless otherwise specified in the PCC, and shall designate
one of such persons to act as a leader with authority to bind the JVCA. The composition or the constitution of the JVCA shall not be altered without the prior consent of the Employer.

10. Project Manager’s Decisions

10.1 Except where otherwise specifically stated, the Project Manager shall decide contractual matters between the Employer and the Contractor in the role representing the Employer.

11. Delegation

11.1 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.

12. Communications

12.1 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.

13. Subcontracting

13.1 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.

14. Other Contractors

14.1 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.

15. Personnel and Equipment

15.1 The Contractor shall employ the key personnel and use the equipment identified in its Bid to carry out the functions stated in the Schedule 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.

15.2 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.

15.3 If the Employer, Project Manager or Contractor determines, that any employee of the Contractor be determined to have engaged in corrupt, fraudulent, collusive, coercive, or other prohibited practices during the execution of the Works, then that employee shall be removed in accordance with Clause 15.2 above.

16. Employer’s and Contractor’s Risks

16.1 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.

17. Employer’s Risks

17.1 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.

17.2 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.

18. Contractor's Risks

18.1 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.

19. Insurance

19.1 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.

19.2 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.

19.3 If the Contractor does not provide any of the policies and certificates required, the Employer may effect 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.
19.4 Alterations to the terms of an insurance shall not be made without the approval of the Project Manager.

19.5 Both parties shall comply with any conditions of the insurance policies.

20. Site Investigation Reports

20.1 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 Contractor.

21. Contractor to Construct the Works

21.1 The Contractor shall construct and install the Works in accordance with the Specifications and Drawings.

22. The Works to Be Completed by the Intended Completion Date

22.1 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.

23. Designs by Contractor and Approval by the Project Manager

23.1 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.

23.2 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.

23.3 The Contractor shall be responsible for design of Temporary Works.

23.4 The Project Manager’s approval shall not alter the Contractor’s responsibility for design of the Temporary Works.

23.5 The Contractor shall obtain approval of third parties to the design of the Temporary Works, where required.

23.6 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.

24. Safety

24.1 The Contractor shall be responsible for the safety of all activities on the Site.

25. Discoveries

25.1 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.

26. Possession of

26.1 The Employer shall give possession of all parts of the Site to the
the Site

the Site
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.

27. Access to the

Site
27.1 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.

28. Instructions,

Inspections and

Audits
28.1 The Contractor shall carry out all instructions of the Project Manager
which comply with the applicable laws where the Site is located.

28.2 The Contractor shall keep, and shall make all reasonable efforts to
cause its Subcontractors and subconsultants to keep accurate and
systematic accounts and records in respect of the Works in such form
and details as will clearly identify relevant time changes and costs.

28.3 The Contractor shall permit ADB 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 ADB. 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 ADB.

29. Appointment of

the Adjudicator
29.1 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 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.

29.2 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.

30. Procedure for

Disputes
30.1 If the Contractor believes that a decision taken by the Project Manager
was either outside the authority given to the Project Manager by the
Contract or that the decision was wrongly taken, the decision shall be
referred to the Adjudicator within 14 days of the notification of the
Project Manager's decision.

30.2 The Adjudicator shall give a decision in writing within 28 days of receipt
of a notification of a dispute.

30.3 The Adjudicator shall be paid by the hour at the rate specified in the
PCC, together with reimbursable expenses of the types specified in the
PCC, and the cost shall be divided equally between the Employer and
the Contractor, whatever decision is reached by the Adjudicator.
Either party may refer a decision of the Adjudicator to an Arbitrator
30.4 The arbitration shall be conducted in accordance with the arbitration procedures published by the institution named and in the place specified in the **PCC**.

### B. Staff and Labor

**31. Forced Labor**

31.1 The Contractor shall not employ forced labor, which consists of any work or service, not voluntarily performed, that is exacted from an individual under threat of force or penalty. This covers any kind of involuntary or compulsory labor, such as indentured labor, bonded labor or similar labor–contracting arrangements.

**32. Child Labor**

32.1 The Contractor shall not employ children in a manner that is economically exploitative, or is likely to be hazardous, or to interfere with, the child's education, or to be harmful to the child's health or physical, mental, spiritual, moral, or social development. Where national laws have provisions for employment of minors, the Contractor shall follow those laws applicable to the Contractor. Children below the age of 18 years shall not be employed in dangerous work.

**33. Workers' Organizations**

33.1 In countries where national law recognizes workers' rights to form and to join workers' organizations of their choosing without interference and to bargain collectively, the Contractor shall comply with national law. Where national law substantially restricts workers' organizations, the Contractor shall enable alternative means for the Contractor's Personnel to express their grievances and protect their rights regarding working conditions and terms of employment. In either case described above, and where national law is silent, the Contractor shall not discourage the Contractor's Personnel from forming or joining workers' organizations of their choosing or from bargaining collectively, and shall not discriminate or retaliate against the Contractor's Personnel who participate, or seek to participate, in such organizations and bargain collectively. The Contractor shall engage with such workers representatives. Worker organizations are expected to fairly represent the workers in the workforce.

**34. Non-Discrimination and Equal Opportunity**

34.1 The Contractor shall not make employment decisions on the basis of personal characteristics unrelated to inherent job requirements. The Contractor shall base the employment relationship on the principle of equal opportunity and fair treatment, and shall not discriminate with respect to aspects of the employment relationship, including recruitment and hiring, compensation (including wages and benefits), working conditions and terms of employment, access to training, promotion, termination of employment or retirement, and discipline. In countries where national law provides for non-discrimination in employment, the Contractor shall comply with national law. When national laws are silent on non-discrimination in employment, the Contractor shall meet this Sub-Clause's requirements. Special measures of protection or assistance to remedy past discrimination or selection for a particular job based on the inherent requirements of the job shall not be deemed discrimination.
C. Time Control

35. Program

35.1 Within the time stated in the PCC, after the date of the Letter of Acceptance, 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.

35.2 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.

35.3 The Contractor shall submit to the Project Manager for approval an updated Program at intervals no longer than the period stated in the PCC. If the Contractor does not submit an updated Program within this period, the 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.

35.4 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 Manager again at any time. A revised Program shall show the effect of Variations and Compensation Events.

36. Extension of the Intended Completion Date

36.1 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.

36.2 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.

37. Acceleration

37.1 When the Employer wants the Contractor to finish before the Intended Completion Date, the Project Manager shall obtain priced proposals for achieving the necessary acceleration 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.

37.2 If the Contractor’s priced proposals for an acceleration are accepted by the Employer, they are incorporated in the Contract Price and treated as a Variation.

38. Delays Ordered by the Project Manager

38.1 The Project Manager may instruct the Contractor to delay the start or progress of any activity within the Works.
### 39. Management Meetings

39.1 Either the Project Manager or the Contractor may require the other to attend a 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.

39.2 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.

### 40. Early Warning

40.1 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.

40.2 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.

### D. Quality Control

#### 41. Identifying Defects

41.1 The Project Manager 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.

#### 42. Tests

42.1 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.

#### 43. Correction of Defects

43.1 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.

43.2 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.

#### 44. Uncorrected Defects

44.1 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.
E. Cost Control

45. Contract Price

45.1 In the case of an admeasurement 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.

45.2 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.

46. Changes in the Contract Price

46.1 In the case of an admeasurement 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.

46.2 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.

47. Variations

47.1 All Variations shall be included in updated Programs, and, in the case of a lump sum contract, also in the Activity Schedule, produced by the Contractor.

47.2 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 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.

47.3 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.
47.4 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.

47.5 The Contractor shall not be entitled to additional payment for costs that could have been avoided by giving early warning.

47.6 In the case of an admeasurement contract, if the work in the Variation corresponds to an item description in the Bill of Quantities and if, in the opinion of the Project Manager, the quantity of work above the limit stated in GCC 46.1 [Changes in the Contract Price] or the timing of its execution do not cause the cost per unit of quantity to change, the rate in the Bill of Quantities shall be used to calculate the value of the 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 items in the Bill of Quantities, the quotation by the Contractor shall be in the form of new rates for the relevant items of work.

48. Cash Flow Forecasts

48.1 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.

49. Payment Certificates

49.1 The Contractor shall submit to the Project Manager monthly statements of the estimated value of the work executed less the cumulative amount certified previously.

49.2 The Project Manager shall check the Contractor’s monthly statement and certify the amount to be paid to the Contractor.

49.3 The value of work executed shall be determined by the Project Manager.

49.4 The value of work executed shall comprise:

(a) In the case of an admeasurement 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.

49.5 The value of work executed shall include the valuation of Variations and Compensation Events.

49.6 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.

50. Payments

50.1 Payments shall be adjusted for deductions for advance payments and retention. The Employer shall pay the Contractor the amounts certified
by the Project Manager within 28 days of the date of each certificate. If the Employer makes a late payment, the Contractor shall be paid interest on the late payment in the next payment. Interest shall be calculated from the date by which the payment should have been made up to the date when the late payment is made at the prevailing rate of interest for commercial borrowing for each of the currencies in which payments are made.

50.2 If an amount certified is increased in a later certificate or as a result of an award by the Adjudicator or an Arbitrator, the Contractor shall be paid interest upon the delayed payment as set out in this clause. Interest shall be calculated from the date upon which the increased amount would have been certified in the absence of dispute.

50.3 Unless otherwise stated, all payments and deductions shall be paid or charged in the proportions of currencies comprising the Contract Price.

50.4 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.

51. Compensation Events

51.1 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 26.1 [Possession of the Site].

(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, or instructions 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) The Project Manager unreasonably does not approve a subcontract to be let.

(f) 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.

(g) 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.

(h) 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.

(i) The advance payment is delayed.
(j) The effects on the Contractor of any of the Employer’s Risks.

(k) The Project Manager unreasonably delays issuing a Certificate of Completion.

51.2 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.

51.3 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.

51.4 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.

52. Tax

52.1 The Project Manager shall adjust the Contract Price if taxes, duties, and other levies are changed between the date 28 days before the submission of bids for the Contract and the date of the last Completion certificate. The adjustment shall be the change in the amount of tax payable by the Contractor, provided such changes are not already reflected in the Contract Price or are a result of GCC 54.1 [Price Adjustment].

53. Currencies

53.1 Where payments are made in currencies other than the currency of the Employer’s country specified in the PCC, the exchange rates used for calculating the amounts to be paid shall be the exchange rates stated in the Contractor’s Bid.

54. Price Adjustment

54.1 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. A separate formula of the type indicated below applies to each Contract currency:

\[ P_c = A_c + B_c \frac{Imc}{loc} \]

where:

- \( P_c \) is the adjustment factor for the portion of the Contract Price payable in a specific currency “c.”
A\textsubscript{c} and B\textsubscript{c} are coefficients\textsuperscript{2} specified in the PCC, representing the nonadjustable and adjustable portions, respectively, of the Contract Price payable in that specific currency "c," and Im\textsubscript{c} is a consolidated index prevailing at the end of the month being invoiced and Ioc is the same consolidated index prevailing 28 days before Bid opening for inputs payable; both in the specific currency "c."

54.2 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.

55. Retention

55.1 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.

55.2 Upon the issue of a Certificate of Completion of the Works by the Project Manager, in accordance with GCC 69.1 [Completion], 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 "on demand" bank guarantee.

56. Liquidated Damages

56.1 The Contractor shall pay liquidated damages to the Employer 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.

56.2 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 50.1 [Payments].

57. Bonus

57.1 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.

\textsuperscript{2} The sum of the two coefficients A\textsubscript{c} and B\textsubscript{c} should be 1 (one) in the formula for each currency. Normally, both coefficients shall be the same in the formulae for all currencies, since coefficient A\textsubscript{c} for the nonadjustable portion of the payments, is a very approximate figure (usually 0.10 ~ 0.20) to take account of fixed cost elements or other nonadjustable components. The sum of the adjustments for each currency are added to the Contract Price.
58. Advance Payment

58.1 The Employer shall make advance payment to the Contractor of the amounts stated in the PCC by the date stated in the PCC, against provision by the Contractor of an unconditional bank guarantee in a form and by a bank acceptable to the Employer in amounts and currencies equal to the advance payment. The guarantee shall remain effective until the advance payment has been repaid, but the amount of the guarantee shall be progressively reduced by the amounts repaid by the Contractor. Interest shall not be charged on the advance payment.

58.2 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.

58.3 The advance payment shall be repaid by deducting proportionate amounts from payments otherwise due to the Contractor, following the schedule of completed percentages of the Works on a payment basis. No account shall be taken of the advance payment or its repayment in assessing valuations of work done, Variations, price adjustments, Compensation Events, Bonuses, or Liquidated Damages.

59. Securities

59.1 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.

60. Dayworks

60.1 If applicable, the Dayworks 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.

60.2 All work to be paid for as Dayworks 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.

60.3 The Contractor shall be paid for Dayworks subject to obtaining signed Dayworks forms.

61. 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.
F. Force Majeure

62. Definition of Force Majeure

62.1 In this Clause, “Force Majeure” means an exceptional event or circumstance:

(a) which is beyond a Party’s control,

(b) which such Party could not reasonably have provided against before entering into the Contract,

(c) which, having arisen, such Party could not reasonably have avoided or overcome, and

(d) which is not substantially attributable to the other Party.

62.2 Force Majeure may include, but is not limited to, exceptional events or circumstances of the kind listed below, so long as conditions (a) to (d) above are satisfied:

(a) war, hostilities (whether war be declared or not), invasion, act of foreign enemies,

(b) rebellion, terrorism, sabotage by persons other than the Contractor’s Personnel, revolution, insurrection, military or usurped power, or civil war,

(c) riot, commotion, disorder, strike or lockout by persons other than the Contractor’s Personnel,

(d) munitions of war, explosive materials, ionising radiation or contamination by radio-activity, except as may be attributable to the Contractor’s use of such munitions, explosives, radiation or radio-activity, and

(e) natural catastrophes such as earthquake, hurricane, typhoon or volcanic activity.

63. Notice of Force Majeure

63.1 If a Party is or will be prevented from performing its substantial obligations under the Contract by Force Majeure, then it shall give notice to the other Party of the event or circumstances constituting the Force Majeure and shall specify the obligations, the performance of which is or will be prevented. The notice shall be given within 14 days after the Party became aware, or should have become aware, of the relevant event or circumstance constituting Force Majeure.

63.2 The Party shall, having given notice, be excused performance of its obligations for so long as such Force Majeure prevents it from performing them.

63.3 Notwithstanding any other provision of this Clause, Force Majeure shall not apply to obligations of either Party to make payments to the other Party under the Contract.

64. Duty to Minimize Delay

64.1 Each Party shall at all times use all reasonable endeavours to minimize any delay in the performance of the Contract as a result of Force Majeure.

64.2 A Party shall give notice to the other Party when it ceases to be
affected by the Force Majeure.

65. Consequences of Force Majeure

65.1 If the Contractor is prevented from performing its substantial obligations under the Contract by Force Majeure of which notice has been given under GCC Sub-Clause 63 [Notice of Force Majeure], and suffers delay and/or incurs Cost by reason of such Force Majeure, the Contractor shall be entitled subject to GCC Sub-Clause 30.1 [Procedure for Disputes] to:

(a) an extension of time for any such delay, if completion is or will be delayed, under GCC Sub-Clause 36 [Extension of the Intended Completion Date], and

(b) if the event or circumstance is of the kind described in sub-paragraphs (a) to (d) of GCC Sub-Clause 62.2 [Definition of Force Majeure] and, in the case of sub-paragraphs (b) to (d), occurs in the Country, payment of any such Cost, including the costs of rectifying or replacing the Works and/or Goods damaged or destructed by Force Majeure, to the extent they are not indemnified through the insurance policy referred to in GCC Sub-Clause 19 [Insurance].

65.2 After receiving this notice, the Project Manager shall proceed in accordance with GCC Sub-Clause 10 [Project Manager's Decisions] to agree or determine these matters.

66. Force Majeure Affecting Subcontractor

66.1 If any Subcontractor is entitled under any contract or agreement relating to the Works to relief from force majeure on terms additional to or broader than those specified in this Clause, such additional or broader force majeure events or circumstances shall not excuse the Contractor's non-performance or entitle him to relief under this Clause.

67. Optional Termination, Payment and Release

67.1 If the execution of substantially all the Works in progress is prevented for a continuous period of 84 days by reason of Force Majeure of which notice has been given under GCC Sub-Clause 63 [Notice of Force Majeure], or for multiple periods which total more than 140 days due to the same notified Force Majeure, then either Party may give to the other Party a notice of termination of the Contract. In this event, the termination shall take effect 7 days after the notice is given, and the Contractor shall proceed in accordance with GCC Sub-Clause 73.5 [Termination].

67.2 Upon such termination, the Project Manager shall determine the value of the work done and issue a Payment Certificate which shall include:

(a) the amounts payable for any work carried out for which a price is stated in the Contract;

(b) the Cost of Plant and Materials ordered for the Works which have been delivered to the Contractor, or of which the Contractor is liable to accept delivery; this Plant and Materials shall become the property of (and be at the risk of) the Employer when paid for by the Employer, and the Contractor shall place the same at the Employer's disposal;

(c) other Costs or liabilities which in the circumstances were reasonably and necessarily incurred by the Contractor in the
expectation of completing the Works;

(d) the Cost of removal of Temporary Works and Contractor’s Equipment from the Site and the return of these items to the Contractor’s works in his country (or to any other destination at no greater cost); and

(e) the Cost of repatriation of the Contractor’s staff and labor employed wholly in connection with the Works at the date of termination.

68. Release from Performance

68.1 Notwithstanding any other provision of this Clause, if any event or circumstance outside the control of the Parties (including, but not limited to, Force Majeure) arises which makes it impossible or unlawful for either or both Parties to fulfil its or their contractual obligations or which, under the law governing the Contract, entitles the Parties to be released from further performance of the Contract, then upon notice by either Party to the other Party of such event or circumstance:

(a) the Parties shall be discharged from further performance, without prejudice to the rights of either Party in respect of any previous breach of the Contract, and

(b) the sum payable by the Employer to the Contractor shall be the same as would have been payable under GCC Sub-Clause 67 [Optional Termination, Payment and Release] if the Contract had been terminated under GCC Sub-Clause 67.

G. Finishing the Contract

69. Completion

69.1 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.

70. Taking Over

70.1 The Employer shall take over the Site and the Works within seven days of the Project Manager’s issuing a certificate of Completion.

71. Final Account

71.1 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.

72. Operating and Maintenance Manuals

72.1 If “as built” Drawings and/or operating and maintenance manuals are required, the Contractor shall supply them by the dates stated in the PCC.

72.2 If the Contractor does not supply the Drawings and/or manuals by the dates stated in the PCC pursuant to GCC 72.1, or they do not receive the Project Manager’s approval, the Project Manager shall withhold the
amount stated in the PCC from payments due to the Contractor.

**73. Termination**

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

73.2 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;

(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 Project Manager gives two consecutive Notices to update the Program and accelerate the works to ensure compliance with GCC Sub-Clause 22.1 [The Works to be Completed by the Intended Completion Date] and the Contractor fails to update the Program and demonstrate acceleration of the works within a reasonable period of time determined by the Project Manager;

(g) the Contractor does not maintain a Security, which is required;

(h) 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; and

(i) 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 74.1 [Fraud and Corruption].

73.3 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 73.2 above, the Project Manager shall decide whether the breach is fundamental or not.

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

73.5 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.
74. Fraud and Corruption

74.1 ADB’s Anticorruption Policy requires that Borrowers (including beneficiaries of ADB-financed activity), as well as Contractors, Subcontractors, manufacturers, and Consultants under ADB-financed contracts, observe the highest standard of ethics during the procurement and execution of such contracts. In pursuance of this policy, the ADB:

(a) 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 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;

   (v) “integrity violation” means any act, as defined under ADB’s Integrity Principles and Guidelines, which violates ADB’s Anticorruption Policy including corrupt, fraudulent, coercive, or collusive practice, abuse, and obstructive practice.

   (vi) “obstructive practice” means (a) deliberately destroying, falsifying, altering or concealing of evidence material to an ADB investigation; (b) making false statements to investigators in order to materially impede an ADB investigation; (c) failing to comply with requests to provide information, documents or records in connection with an OAI investigation; (d) threatening, harassing, or intimidating any party to prevent it from disclosing its knowledge of matters relevant to the investigation or from pursuing the investigation, or (e) materially impeding ADB’s contractual rights of audit or access to information.

(b) 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, coercive, or obstructive practices or other integrity violations in competing for the Contract;

(c) will cancel the portion of the financing allocated to a contract if it determines at any time that representatives of the borrower or of a beneficiary of ADB-financing engaged in corrupt, fraudulent, collusive, coercive, or obstructive practices or other integrity violations during the procurement or the execution of that contract, without the borrower having taken timely and appropriate action satisfactory to ADB to remedy the situation;
and

(d) will sanction impose remedial actions on a firm or an individual, at any time, in accordance with ADB’s Anticorruption Policy and Integrity Principles and Guidelines (both as amended from time to time), including declaring ineligible, either indefinitely or for a stated period of time, to participate in ADB-financed, or administered or supported activities or to benefit from an ADB-financed, administered or supported 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, coercive, or obstructive practices or other integrity violations.

75. Payment upon Termination

75.1 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.

75.2 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.

76. Property

76.1 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.

77. Release from Performance

77.1 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.

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3 Whether as a contractor, nominated subcontractor, consultant, manufacturer or supplier, or service provider; or in any other capacity (different names are used depending on the particular bidding document). A nominated subcontractor is one which either has been: (i) included by the Bidder in its pre-qualification application or bid because it brings specific and critical experience and know-how that are accounted for in the evaluation of the Bidder’s pre-qualification application or the bid; or (ii) appointed by the Employer.
78. Suspension of ADB Loan or Credit

78.1 In the event that the ADB suspends the Loan or Credit to the Employer, from which part of the payments to the Contractor are being made:

(a) The Employer is obligated to notify the Contractor, with copy to the Project Manager, of such suspension within 7 days of having received the ADB’s suspension notice.

(b) If the Contractor has not received sums due it within the 28 days for payment provided for in GCC 50.1 [Payments], the Contractor may immediately issue a 14-day termination notice.

79. Eligibility

79.1 The Contractor shall have the nationality of an eligible country as specified in Section 5 [Eligible Countries] of the bidding document. 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.

79.2 The materials, equipment and services to be supplied under the Contract shall have their origin in eligible source countries as specified in Section 5 [Eligible Countries] of the bidding document 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.

79.3 For purposes of GCC 79.2, “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.
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.

Appendix-1 Environmental Monitoring Plan (EMP)

Appendix -2 EMP Budget
### A. General

| GCC 1.1 (d) | The financing institution is **Asian Development Bank**. |
|GCC 1.1 (r) | The Employer is: **Department of Tourism Government of Uttarakhand**.  
The Address is:  
The Program Director,  
Program Management Unit  
Infrastructure Development Investment Program for Tourism  
Government of Uttarakhand, Pandit Deendyal Upadhaya Paryatan Bhawan  
Garhi Cantonment, Dehradun-248003  
Tel:-91-135-2559987/2559985,Fax:-91-135-2559988  
E-Mail:utdb.pmu@gmail.com |
| GCC 1.1 (w) | The Intended Completion Date for the whole of the Works shall be **24 months** from the "Start Date". |
| GCC 1.1 (cc) | The Project Manager is: Project Manager, **Project Implementation Unit (PIU)**  
Dehradun, IDIPT-UK, Uttarakhand.  

| GCC 1.1 (ff) | The Site is located at in **Rudraprayag district** as defined in Drawing No :  
UK/KAR/MASTERPLAN/01, Name: **PROPOSED MASTER PLAN AT KARTIKEY SWAMI** |
| GCC 1.1 (ii) | The Start Date shall be: **the date of signing of Contract Agreement**. |
| GCC 1.1 (mm) | The Works consist of construction of infrastructure facilities for pilgrims and tourist visiting Kartikeyaswami Temple; e.g. – Retaining, Breast walls, Rest shelter, View point, Toilet, Pedestrian Pathway, Railing, Rest Shelter, Entrance Gate, Renovation of Toilets, etc.. |
| GCC 2.2 | Sectional Completions are: **Not Applicable** |
| GCC 2.3(j) | The following documents also form part of the Contract:  
- Initial Environmental Examination (IEE) attached hereto as **Appendix 1**  
- Environmental Management Plan (EMP) attached hereto as **Appendix 2** |
| GCC 3.1 | The language of the contract is: **English**.  
The law that applies to the Contract is the law of **India**. |
| GCC 11.1 | The Project Manager, PIU – **Dehradun**, may delegate any of his duties and responsibilities to other people as per GCC clause no – 11.1. |
| GCC 14.1 | Schedule of other contractors: **Not Applicable**. |
| GCC 19.1 | The minimum insurance amounts and Deductibles (in INR) shall be:  
| Insurance amount | Deductibles (INR) |
### Section 8 Particular Conditions of Contract

<table>
<thead>
<tr>
<th>Condition</th>
<th>INR (lacs)</th>
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<tbody>
<tr>
<td>(a) for the Works, Plant and Materials;</td>
<td>INR 1.00 lacs</td>
</tr>
<tr>
<td>(b) for loss or damages to equipment;</td>
<td>INR 1.00 lacs</td>
</tr>
<tr>
<td>(c) for loss or damage to property (except the Works, Plant, Materials and Equipment) in connection with Contract;</td>
<td>INR 1.00 lacs</td>
</tr>
</tbody>
</table>
| (d) for personal injury or death;  
  (i) of the Contractor’s employees;  
  (ii) of other people | INR 1.00 lacs | INR 1.10 lacs |

**GCC 20.1**  
Site Investigation Reports are: Initial Environmental Examination report.

**GCC 21.1**  
The following sub-paragraph is added to the GCC clause: The Contractor shall adequately record the condition of roads, agricultural land and other infrastructure prior to the start of transportation of materials, goods and equipment and construction.

**GCC 23.1**  
The following shall be designed by the Contractor: Nil

**GCC 24.1**  
The following sub-paragraphs are added to the GCC clause: The Contractor shall at all times take all reasonable precautions to maintain the health and safety of the Contractor’s Personnel and to provide a safe work environment.

  The Contractor shall conduct health and safety programs for workers employed under the project and disseminate information at work sites on the risks of sexually transmitted diseases including HIV / AIDS.

**GCC 26.1**  
The Site Possession Date(s) shall be: the date of signing of Contract Agreement.

**GCC 27.1**  
The following sub-paragraphs are added to the GCC clause: The contractor shall comply with (i) the measures and requirement set forth in the resettlement plan attached hereto as Appendix – A, to the extent it concerns / impacts affected people during construction and (ii) any corrective or preventive actions set out in safeguards monitoring reports that the Employer will prepare from time to time to monitor implementation of the resettlement plan.

  The contractor shall allocate a budget for compliance with these measures, requirements and actions.

**GCC 29.1**  
Appointing Authority for the Adjudicator:

Chairperson of Institute of Engineers, 'Uttarakhand' State Centre.
| GCC 30.3 | The Adjudicator shall be paid at the rate of: INR 5000/- per day or as mutually agreed by both parties with indicative reimbursable expenses for conveyance, stay and secretarial services. |
| GCC 30.4 | Institution whose arbitration procedures shall be used: |
|          | **Contracts with foreign contractors:** |
|          | International arbitration shall be conducted in accordance with the rules of the Singapore International Arbitration Centre (SIAC). |
|          | Arbitration shall be administered by SIAC. |
|          | The place of arbitration shall be: the place of the institution administering the arbitration. |
|          | **Contracts with domestic contractors:** |
|          | Arbitration shall be conducted in accordance with the Indian Arbitration and Conciliation Act, 1996 or any statutory modification or enactment thereof. |
|          | The place of arbitration shall be: Dehradun, Uttarakhand. |
|          | The language of arbitration shall be: English. |

**B. Staff and Labour**

| GCC 32.1 | The existing GCC clause is deleted and replaced with the following: The Contractor shall not employ any child to perform any work, including work that is economically exploitative, or is likely to be hazardous to, or to interfere with, the child's education, or to be harmful to the child's health or physical, mental, spiritual, moral, or social development. “Child” means a child below the statutory minimum age specified under applicable national law. Where national laws have provisions for employment of minors, the Contractor shall follow those laws applicable to the Contractor. Children below the age of 18 years shall not be employed in dangerous work. |
| GCC 34.1 | The following sub-paragraphs are added to the GCC clause: The Contractor shall comply with all relevant (a) labour laws and regulations applicable to the Contractors personnel, including staff, consultants, contractor and agents; and (b) workplace health and safety laws. |

**C. Time Control**

| GCC 35.1 | The Contractor shall submit for approval a Program for the Works within 21 days from the date of the Letter of Acceptance. |
**GCC 35.3**  
The period between Program updates is **30** days.  
The amount to be withheld for late submission of an updated Program is **INR 50,000**.

**GCC 40.1**  
**The following sub-paragraphs are added to the GCC clause:** In addition to notice of any unforeseeable physical conditions, the contractor shall provide the engineer with a written notice of any un-anticipated environmental, resettlement, Indigenous peoples risks or impacts that arise during construction, implementation or operation of the plant or permanent works, which were not considered in the IEE or EMP, DDR/RP.  
Resettlement Plan (RP)/Due Diligence Report (DDR), Indigenous Peoples Plan (IP), attached hereto as **Appendices – A, B** as the case may be.

**D. Quality Control**

**GCC 43.1**  
The Defects Liability Period is: **365 days**.

**E. Cost Control**

**GCC 53.1**  
The currency of the Employer’s country is: **Indian Rupees (INR)**

**GCC 54.1**  
The Contract shall be subject to price adjustment in accordance with GCC Clause 54, and the following information regarding coefficients shall apply.  
The coefficients and indices for adjustment of prices in local and international currencies shall be as specified in the Table(s) of Adjustment Data submitted together with the Letter of Price Bid.

**GCC 55.1**  
The proportion of payments retained is: **10%** from each payment due to the Contractor subject to **maximum of 5% of the Contract Price**.

**GCC 56.1**  
The liquidated damages for the whole of the Works are **0.05% of the Contract price** per day. The **maximum amount of liquidated damages** for the whole of the Works is **10% of the Contract Price**.

**GCC 57.1**  
Delete the Sub Clause 57.1 as Bonus is **not applicable**

**GCC 58.1**  
The Advance Payments shall be: **10%** of the Contract Price and shall be paid to the Contractor no later than 28 days from the date of submission of Bank Guarantee made against the said payment.

**GCC 58.3**  
Repayment of advances shall commence at the time of the next running payment following that in which the total estimated value of the permanent works executed, has reached **20%** of contract price. The deduction shall be made at the rate of **20%** (twenty percent) of the gross amount of subsequent running Payment until such time as the total advance has been repaid by the contractor, always provided further that the repayment of advance shall be completed when **80%** of the contract price of the work has been paid.
<table>
<thead>
<tr>
<th>GCC 59.1</th>
<th>The Performance Security amount is <strong>10%</strong> of Contract Price.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>G. Finishing the Contract</strong></td>
<td></td>
</tr>
<tr>
<td>GCC 69.1</td>
<td><strong>The following sub-paragraphs are added to the GCC clause:</strong> Upon the completion of construction, the contractor shall fully reinstate pathways, other local infrastructure, and agricultural land to at least their pre-project condition, as recorded by the contractor in consonance with its obligation in PCC Clause 21.1</td>
</tr>
<tr>
<td>GCC 72.1</td>
<td>The date by which “as built” drawings, only are required is: <strong>With request letter of Certificate of Completion of the “Works” as per GCC 69.1.</strong></td>
</tr>
<tr>
<td>GCC 72.2</td>
<td>The amount to be withheld for failing to produce “as built” drawings only by the date required in GCC 72.1 is <strong>1% of Contract Price.</strong></td>
</tr>
</tbody>
</table>
| GCC 73.2 | **The following sub-paragraphs are added to the GCC clause:**  
(i) If the contractor has breached its obligation under clauses 31 to 34. |
| GCC 73.2 (h) | The maximum number of days is: **200 days.** |
| GCC 75.1 | The percentage to apply to the value of the work not completed, representing the Employer’s additional cost for completing the Works, is **5%** percent of the Contract Price. |
| **Add a new PCC clause 80:** |
| “The contractor shall comply with all applicable national, provincial, and local environmental laws and regulations. The Contractor shall (a) establish and operational system for managing environmental impact, (b) carry out all of the monitoring and mitigation measures set forth in the IEE and EMP, (c) allocate the budget required to ensure that such measures are carried out, and (d) comply with any corrective or preventive action set out in safeguards monitoring reports, that the employer will prepare from time to time, to monitor implementation of the IEE and EMP. The contractor shall submit quarterly report on the carrying out of such measures to the employer.” |
| **Add a new PCC clause 81:** |
| “The contractor shall provide the employer with quarterly report of its activities including each of its obligation in sub clauses 24, 27, 31, 32, 34 and 80.” |
### Appendix - 1

**Environmental Impacts and Planned Mitigation Measures**

<table>
<thead>
<tr>
<th>Potential Impact</th>
<th>Mitigation Measures</th>
<th>Parameter/ Indicator of Compliance</th>
<th>Responsible for Implementation</th>
<th>Responsible for Supervision</th>
<th>Frequency of Monitoring</th>
<th>Source of Funds</th>
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<tbody>
<tr>
<td>Erosion hazards</td>
<td>Save topsoil removed during excavation and use to reclaim disturbed areas, as soon as it is possible to do so. Use dust abatement such as water spraying to minimize windblown erosion. Provide temporary stabilization of disturbed/excavated areas that are not actively under construction. Apply erosion controls (e.g., silt traps) along the drainage leading to the water bodies. Maintain vegetative cover within road ROWs to prevent erosion and periodically monitor ROWs to assess erosion. Clean and maintain drainage ditches, and culverts regularly. Conduct routine site inspections to assess the effectiveness of and the maintenance requirements for erosion and sediment control systems.</td>
<td>Erosion control and re-vegetation plan</td>
<td>Contractor</td>
<td>PIU and DSC PIU to submit EMP monitoring report to PMU</td>
<td>- daily visual inspection by contractor supervisor and/or environment specialist - weekly visual inspection by DSC (more frequent during monsoon season and if corrective action is required) - random inspection by PMU, PIU, PMC and/or DSC</td>
<td>Contractor</td>
</tr>
<tr>
<td>Impacts on water quality</td>
<td>Schedule construction activities during non monsoon season, to the maximum extent possible. Ensure drainages within the construction zones are kept free of obstructions. Keep loose soil material and stockpiles out of drains and flow-lines. Avoid stockpiling of excavated and construction materials (sand, gravel, cement, etc.) unless covered by tarpaulins or plastic sheets.</td>
<td>Work schedule</td>
<td>Contractor</td>
<td>PIU and DSC PIU to submit EMP monitoring report to PMU</td>
<td>- daily inspection by contractor supervisor and/or environment specialist - weekly visual inspection by DSC (more frequent during monsoon season and if corrective action is required) - random inspection by PMU, PIU, PMC and/or DSC</td>
<td>Contractor</td>
</tr>
<tr>
<td>Potential Impact</td>
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<tr>
<td>Re-use/utilize, to maximum extent possible, excavated materials.</td>
<td>condition in waste management plan</td>
<td>Contractor</td>
<td>PIU and DSC</td>
<td>- daily inspection by contractor supervisor and/or environment specialist - weekly visual inspection by DSC (more frequent during dry season and if corrective action is required) - random inspection by PMU, PIU, PMC and/or DSC</td>
<td>Contractor</td>
<td></td>
</tr>
<tr>
<td>Dispose any residuals at identified disposal site (PIU/DSC will identify approved sites).</td>
<td>condition in waste management plan</td>
<td>Contractor</td>
<td>PIU and DSC</td>
<td>- daily inspection by contractor supervisor and/or environment specialist - weekly visual inspection by DSC (more frequent during dry season and if corrective action is required) - random inspection by PMU, PIU, PMC and/or DSC</td>
<td>Contractor</td>
<td></td>
</tr>
<tr>
<td>Dispose waste oil and lubricants generated as per provisions of Hazardous Waste (Management and Handling) Rules, 1989.</td>
<td>condition in waste management plan</td>
<td>Contractor</td>
<td>PIU and DSC</td>
<td>- daily inspection by contractor supervisor and/or environment specialist - weekly visual inspection by DSC (more frequent during dry season and if corrective action is required) - random inspection by PMU, PIU, PMC and/or DSC</td>
<td>Contractor</td>
<td></td>
</tr>
<tr>
<td>Refuel equipment within the designated refueling containment area away from drainages, nallahs, or water body.</td>
<td>condition in list of pre-approved sites for construction work camps, areas for stockpile, storage and disposal</td>
<td>Contractor</td>
<td>PIU and DSC</td>
<td>- daily inspection by contractor supervisor and/or environment specialist - weekly visual inspection by DSC (more frequent during dry season and if corrective action is required) - random inspection by PMU, PIU, PMC and/or DSC</td>
<td>Contractor</td>
<td></td>
</tr>
<tr>
<td>Inspect all vehicles daily for fluid leaks before leaving the vehicle staging area, and repair any leaks before the vehicle resumes operation.</td>
<td>Vehicle inspection report</td>
<td>Contractor</td>
<td>PIU and DSC</td>
<td>- daily inspection by contractor supervisor and/or environment specialist - weekly visual inspection by DSC (more frequent during dry season and if corrective action is required) - random inspection by PMU, PIU, PMC and/or DSC</td>
<td>Contractor</td>
<td></td>
</tr>
<tr>
<td>Impacts on air quality</td>
<td>Conduct regular water spraying on stockpiles.</td>
<td>Visual inspection - No complaints from sensitive receptors Records</td>
<td>Contractor</td>
<td>PIU and DSC</td>
<td>- daily inspection by contractor supervisor and/or environment specialist - weekly visual inspection by DSC (more frequent during dry season and if corrective action is required) - random inspection by PMU, PIU, PMC and/or DSC</td>
<td>Contractor</td>
</tr>
<tr>
<td>Conduct regular visual inspection in the construction zones to ensure no excessive dust emissions.</td>
<td>Visual inspection PUC certificates</td>
<td>Contractor</td>
<td>PIU and DSC</td>
<td>- daily inspection by contractor supervisor and/or environment specialist - weekly visual inspection by DSC (more frequent during dry season and if corrective action is required) - random inspection by PMU, PIU, PMC and/or DSC</td>
<td>Contractor</td>
<td></td>
</tr>
<tr>
<td>Maintain construction vehicles and obtain “pollution under control” certificate from Uttarakhand Pollution Control Board.</td>
<td>PUC certificates</td>
<td>Contractor</td>
<td>PIU and DSC</td>
<td>- daily inspection by contractor supervisor and/or environment specialist - weekly visual inspection by DSC (more frequent during dry season and if corrective action is required) - random inspection by PMU, PIU, PMC and/or DSC</td>
<td>Contractor</td>
<td></td>
</tr>
<tr>
<td>Noise and vibrations impacts</td>
<td>Limit construction activities in temple complexes and other important areas to daytime only. Plan activities in consultation with PIU/DSC so that activities with the greatest potential to generate noise are conducted during periods of</td>
<td>Work schedule Contractor J and DSC</td>
<td>- daily inspection by contractor supervisor and/or environment specialist - weekly visual inspection by DSC (more frequent during dry season and if corrective action is required) - random inspection by PMU, PIU, PMC and/or DSC</td>
<td>Contractor</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Bidding Document for IDIPT (UK)  Contract Package No: UK/IDIPT-III/ DDN/ 02
<table>
<thead>
<tr>
<th>Potential Impact</th>
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<th>Source of Funds</th>
</tr>
</thead>
<tbody>
<tr>
<td>Impacts on flora and fauna</td>
<td>Conduct site induction and environmental awareness at Katikaya swami</td>
<td>Records</td>
<td>Contractor</td>
<td>PIU and DSC</td>
<td>- daily inspection by contractor supervisor and/or environment specialist - weekly visual inspection by DSC (more frequent if corrective action is required) - random inspection by PMU, PIU, PMC and/or DSC</td>
<td>Contractor</td>
</tr>
<tr>
<td></td>
<td>Limit activities within the work area.</td>
<td>Barricades along excavation works</td>
<td>Contractor</td>
<td>DSC</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Impacts on physical cultural</td>
<td>Ensure no damage to structures/properties adjacent to construction zone.</td>
<td>- Visual inspection - any impact should be addressed by project resettlement</td>
<td>Contractor</td>
<td>PIU and DSC</td>
<td>-daily inspection by contractor supervisor and/or environment specialist</td>
<td>Contractor</td>
</tr>
<tr>
<td>Potential Impact</td>
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<tr>
<td>resources</td>
<td>Provide sign boards to inform nature and duration of construction works and contact numbers for concerns/complaints.</td>
<td>plan</td>
<td>any structures within WTP site and construction zone</td>
<td></td>
<td>- weekly visual inspection by DSC (more frequent if corrective action is required) - random inspection by PMU, PIU, PMC and/or DSC</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Implement good housekeeping. Remove wastes immediately.</td>
<td>Visual inspection</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ensure workers will not use nearby/adjacent areas as toilet facility.</td>
<td>No complaints</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Coordinate with PIU/DSC for transportation routes and schedule. Schedule transport and hauling activities during non-peak hours. Convey road detours via boards, advertising, pamphlets, etc. This will be taken care during construction of Interpretation center at Rudraprayag</td>
<td>- Approved routes in traffic management plan</td>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td>Provide instructions on event of chance finds for archaeological and/or ethno-botanical resources. Works must be stopped immediately until such time chance finds are cleared by experts.</td>
<td>condition in chance find protocol</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Prepare and implement a waste management plan. Manage solid waste according to the following hierarchy: reuse, recycling and disposal. Include in waste management plan designated/approved disposal areas. Coordinate with PIU/DSC for beneficial uses of excavated soils or immediately dispose to designated areas. Recover used oil and lubricants and reuse; or remove from the site. Prohibit disposal of any material or wastes (including human waste) into drainage, nallah, or watercourse.</td>
<td>condition in waste management plan</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Impact due to waste generation</td>
<td>Comply with IFC EHS Guidelines on Occupational Health and Safety</td>
<td>- Visual inspection</td>
<td>Contractor</td>
<td>PIU and DSC</td>
<td>- daily inspection by contractor supervisor and/or environment specialist</td>
<td>Contractor</td>
</tr>
</tbody>
</table>

Bidding Document for IDIPT (UK)  Contract Package No: UK/IDIPT-III/ DDN/ 02
<table>
<thead>
<tr>
<th>Potential Impact</th>
<th>Mitigation Measures</th>
<th>Parameter/ Indicator of Compliance</th>
<th>Responsible for Implementation</th>
<th>Responsible for Supervision</th>
<th>Frequency of Monitoring</th>
<th>Source of Funds</th>
</tr>
</thead>
<tbody>
<tr>
<td>Impacts on occupational health and safety</td>
<td>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.</td>
<td>- Visual inspection - Work schedule - Noise level monitoring in work area</td>
<td>Contractor</td>
<td>PIU and DSC</td>
<td>- weekly visual inspection by DSC (more frequent if corrective action is required) - random inspection by PMU, PIU, PMC and/or DSC</td>
<td>Contractor</td>
</tr>
<tr>
<td></td>
<td>Provide H&amp;S orientation training to all new workers to ensure that they are apprised of the rules of work at the site, personal protective protection, and preventing injury to fellow workers.</td>
<td>- Records - Condition in UK plan</td>
<td></td>
<td></td>
<td>- daily inspection by contractor supervisor and/or environment specialist - weekly visual inspection by DSC (more frequent if corrective action is required) - random inspection by PMU, PIU, PMC and/or DSC</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ensure that qualified first-aid can be provided at all times. Equipped first-aid stations shall be easily accessible throughout the site as well as at construction camps.</td>
<td>- Visible first aid equipment and medical supplies - Condition in UK plan</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Provide medical insurance coverage for workers.</td>
<td>Records</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Secure construction zone from unauthorized intrusion and accident risks.</td>
<td>- Area secured - Trenches barricaded</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Provide supplies of potable drinking water.</td>
<td>- Supply of water</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Provide clean eating areas where workers are not exposed to hazardous or noxious substances.</td>
<td>- Workers area</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>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.</td>
<td>- Records - Condition in UK plan</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ensure the visibility of workers through their use of high visibility vests when working in or walking through heavy equipment operating areas.</td>
<td>- Visual inspection - Condition in UK plan</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ensure moving equipment is outfitted with audible back-up alarms.</td>
<td>- Construction vehicles - Condition in UK plan</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Mark and provide sign boards in the construction zone, and areas for storage and disposal.</td>
<td>- Visible and understandable sign</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Potential Impact</td>
<td>Mitigation Measures</td>
<td>Parameter/ Indicator of Compliance</td>
<td>Responsible for Implementation</td>
<td>Responsible for Supervision</td>
<td>Frequency of Monitoring of Funds</td>
<td>Source of Funds</td>
</tr>
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<td>------------------------------------------------------------------------------------</td>
<td>--------------------------------------------------------------------------------------------------</td>
<td>-------------------------------</td>
<td>----------------------------</td>
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</tr>
<tr>
<td></td>
<td>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.</td>
<td>boards in construction zone - UK plan includes appropriate signs for each hazard present</td>
<td>Contractor</td>
<td>PIU and DSC</td>
<td>-daily inspection by contractor supervisor and/or environment specialist - weekly visual inspection by DSC (more frequent if corrective action is required) - random inspection by PMU, PIU, PMC and/or DSC</td>
<td>Contractor</td>
</tr>
<tr>
<td>Impacts on socio-economic activities</td>
<td>Provide sign boards for pedestrians to inform nature and duration of construction works and contact numbers for concerns/complaints.</td>
<td>Visible and understandable sign boards in construction zone</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Employ at least 50% of the labor force, or to the maximum extent, local persons within the 2-km immediate area if manpower is available.</td>
<td>Employment records</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Appendix - 2
Environmental management and monitoring costs (INR)
Environmental Budget

<table>
<thead>
<tr>
<th>S.N.</th>
<th>Particulars</th>
<th>Stages</th>
<th>Unit</th>
<th>Total</th>
<th>Rate (INR)</th>
<th>Cost (INR)</th>
<th>Source of fund</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Monitoring Measures</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Air Quality Monitoring</td>
<td>Construction</td>
<td>Per sample</td>
<td>4</td>
<td>10,000</td>
<td>40,000</td>
<td>Contractor budget</td>
</tr>
<tr>
<td>2</td>
<td>Noise Levels Silence Zones</td>
<td>Construction</td>
<td>Per location</td>
<td>4</td>
<td>4,000</td>
<td>16,000</td>
<td>Contractor budget</td>
</tr>
<tr>
<td>3</td>
<td>Ambient Air Quality</td>
<td>Operation</td>
<td>Per Sample</td>
<td>4</td>
<td>10,000</td>
<td>40,000</td>
<td>PMU</td>
</tr>
<tr>
<td>4</td>
<td>Ambient Noise Quality</td>
<td>Operation</td>
<td>Per Sample</td>
<td>4</td>
<td>4,000</td>
<td>16,000</td>
<td>PMU</td>
</tr>
<tr>
<td></td>
<td>Sub- Total (A)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>112,000</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Capacity Building- Training Cost</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Sensitization workshop</td>
<td>Construction</td>
<td>LS</td>
<td>2</td>
<td>100,000</td>
<td>100,000</td>
<td>PMU</td>
</tr>
<tr>
<td></td>
<td>Training Session I</td>
<td>Construction</td>
<td>LS</td>
<td>2</td>
<td>100,000</td>
<td>100,000</td>
<td>PMU</td>
</tr>
<tr>
<td></td>
<td>Training Session II</td>
<td>Construction</td>
<td>LS</td>
<td>2</td>
<td>100,000</td>
<td>100,000</td>
<td>PMU</td>
</tr>
<tr>
<td></td>
<td>Sub- Total (B)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>300,000</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total (A+B) INR</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>412,000</td>
<td></td>
</tr>
</tbody>
</table>

Note: The Contractor has to bear the cost of Environment Monitoring during the Construction Phase amounting to INR: 56,000.00 (Rupees Fifty-six thousand only), from his own Financial Resources.
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.

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Contract Agreement ...................................................................................................................................... 9-3
Performance Security ................................................................................................................................... 9-4
Advance Payment Security .......................................................................................................................... 9-5
Letter of Acceptance

[on letterhead paper of the Employer]

........ date. ........

To: .............. name and address of the Contractor ..............

Subject: .............. Notification of Award Contract No. ..............

This is to notify you that your Bid dated .... date ... consisting of the Technical and Price Bids for execution of the .............. name of the contract and identification number, as given in the Bid Data Sheet .... .... for the Accepted Contract Amount of the equivalent of ........ amount in numbers and words and name of currency ........, as corrected and modified in accordance with the Instructions to Bidders is hereby accepted by our Agency.

You are requested to furnish the Performance Security within 28 days in accordance with the Conditions of Contract, using for that purpose the Performance Security Form included in Section 9 (Contract Forms) of the Bidding Document.

[Choose one of the following statements:]

We accept that __________________________ [insert the name of Adjudicator proposed by the Bidder] be appointed as the Adjudicator.

[or]

We do not accept that __________________________ [insert the name of the Adjudicator proposed by the Bidder] be appointed as the Adjudicator, and by sending a copy of this Letter of Acceptance to __________________________ [insert name of the Appointing Authority], the Appointing Authority, we are hereby requesting such Authority to appoint the Adjudicator in accordance with GCC 29.1.

Authorized Signature: ......................................................................................................................

Name and Title of Signatory: ...........................................................................................................

Name of Agency: ............................................................................................................................

Attachment: Contract Agreement
Contract Agreement

THIS AGREEMENT made the . . . . . . day of . . . . . . . . . . . . . . . . . , . . . . . . . , between . . . . . name of the Employer. . . . . . (hereinafter “the Employer”), of the one part, and . . . . . name of the Contractor. . . . . . (hereinafter “the Contractor”), of the other part:

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

The Employer and the Contractor agree as follows:

1. In this Agreement words and expressions shall have the same meanings as are respectively assigned to them in the Contract documents referred to.

2. The following documents shall be deemed to form and be read and construed as part of this Agreement. This Agreement shall prevail over all other Contract documents.

   (a) the Contract Agreement,
   (b) the Letter of Acceptance,
   (c) the Letters of Technical Bid and Price Bid,
   (d) the Particular Conditions of Contract,
   (e) the List of Eligible Countries that was specified in Section 5 of the bidding document,
   (f) the General Conditions of Contract,
   (g) the Specifications,
   (h) the Drawings,
   (i) the Completed Activity Schedules or Bill of Quantities, and
   (j) any other document listed in the PCC as forming part of the Contract.

3. In consideration of the payments to be made by the Employer to the Contractor as 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 . . . . . . name of the borrowing country. . . . . . on the day, month and year indicated above.

Signed by .........................................................   Signed by ............................................................
for and on behalf of the Employer   for and on behalf the Contractor
in the presence of                 in the presence of

Witness, Name, Signature, Address, Date   Witness, Name, Signature, Address, Date
Performance Security

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

Beneficiary: .................................................................................................................................

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

Performance 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 execution of . . . . . name of contract and brief description of Works . . . . . (hereinafter called "the
Contract").

Furthermore, we understand that, according to the conditions of the Contract, a performance
guarantee is required.

At the request of the Contractor, we . . . . . name of the Bank . . . . . hereby 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, 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 . . . . . . . . . . 2, and any
demand for payment under it must be received by us at this office on or before that date.

This guarantee is subject to the Uniform Rules for Demand Guarantees, ICC Publication No. 458 3,
except that subparagraph (ii) of Sub-article 20(a) is hereby excluded.

.................................................................................................................................

Seal of Bank and Signature(s)

Note -

All italicized text is for guidance on how to prepare this demand guarantee and shall be deleted from the final document.

1. The Guarantor shall insert an amount representing the percentage of the Contract Price specified in the Contract
denominated either in the currency (ies) of the Contract or a freely convertible currency acceptable to the Employer.
If the bank issuing the performance security is located outside the country of the Employer, it shall have a correspondent
financial institution located in the country of the Employer.

2. Insert the date twenty-eight days after the expected completion date. The Employer should note that in the event of
an extension of the time for completion of the Contract, the Employer would need to request an extension of this
guarantee from the Guarantor. Such request must be in writing and must be made prior to the expiration date
established in the guarantee. In preparing this guarantee, the Employer might consider adding the following text to the
form, at the end of the penultimate paragraph: “The Guarantor agrees to a one-time extension of this guarantee for a
period not to exceed [six months][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.”

3. Or 758 as applicable

Note to Bidder -

If the institution issuing the performance security is located outside the country of the Employer, it shall have a
correspondent financial institution located in the country of the Employer to make it enforceable.
**Advance Payment Security**

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

Beneficiary: .................................................... Name and Address of Employer...........................................................

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 execution of . . . . . name of contract and brief description of Works . . . . . (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 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, at the latest, upon our receipt of a copy of the interim payment certificate indicating that eighty percent (80%) of the Contract Price has been certified for payment, or on the . . day of . . . . ., . . , whichever is earlier. Consequently, any demand for payment under this guarantee must be received by us at this office on or before that date.

This guarantee is subject to the Uniform Rules for Demand Guarantees, ICC Publication No. 458.

---

**Note**

All italicized text is for guidance on how to prepare this demand guarantee and shall be deleted from the final document.

The Guarantor shall insert an amount representing the amount of the advance payment denominated either in the currency (ies) of the advance payment as specified in the Contract, or in a freely convertible currency acceptable to the Employer.

Insert the expected expiration date of the Time for Completion. The Employer should note that in the event of an extension of the time for completion of the Contract, the Employer would need to request an extension of this guarantee from the Guarantor. Such request must be in writing and must be made prior to the expiration date established in the guarantee. In preparing this guarantee, the Employer might consider adding the following text to the form, at the end of the penultimate paragraph: "The Guarantor agrees to a one-time extension of this guarantee for a period not to exceed [six months][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.

---

**Note to Bidder**

If the institution issuing the advance payment security is located outside the country of the Employer, it shall have a correspondent financial institution located in the country of the Employer to make it enforceable.
Uttarakhand Tourism Development Board
Government of Uttarakhand

Infrastructure Development Investment Program for Tourism (Project 3)
ADB LOAN No: 3223 – IND

BIDDING DOCUMENT (REBID – 1)
for

Procurement of

Work of

Development of Tourism Infrastructure in Kartikeya Swami Circuit
(Kartikeya Swami Temple)

(Following ADB’s Single Stage - Two Envelope Bidding Procedure)

Volume II - Price Bid

Issued on : 28th December 2015
Invitation for Bid No. : IDIPT (UK)/T3/NCB/W/07/R1/2014-15
Package No. : UK/IDIPT-III/ DDN/ 02

Employer : Uttarakhand Tourism Development Board (UTDB)
Represented by:
The Program Director
Program Management Unit (PMU),
Uttarakhand Tourism Development Board
Pandit Deendayal Upadhyaya Paryatan Bhawan,
Near ONGC Helipad, Garhi Cantt. Dehradun

Country : India
Section 4B - Bidding Forms
- Post qualification -

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<tr>
<th>Form</th>
<th>Pages</th>
</tr>
</thead>
<tbody>
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<td>Letter of Price Bid</td>
<td>2-3</td>
</tr>
<tr>
<td>Bill of Quantities</td>
<td>4-76</td>
</tr>
</tbody>
</table>
Letter of Price Bid

Date: dd-mm-yyyy

Invitation for Bid No: IDIPT (UK)/T3/NCB/W/07/R1/2014-15

NCB Package No: UK/IDIPT-III/ DDN/ 02

To:
The Program Director,

Infrastructure Development Investment Program for Tourism (IDIPT)
Uttarakhand Tourism Development Board (UTDB),
Pandit Deendyal Upadhaya Paryatan Bhawan,
Near ONGC Helipad, Garhi Cantonment,
Dehradun – 248171, India

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;

We offer to execute in conformity with the Bidding Documents the following Works: “Development of Tourism Infrastructure in Kartikeya Swami Circuit (Kartikeya Swami Temple)”. The total price of our Bid, excluding any discounts offered in item (d) below is:

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

c) Our Bid shall be valid for a period of 120 days 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 accordance with the Bidding Documents;

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

<table>
<thead>
<tr>
<th>Name of Recipient</th>
<th>Address</th>
<th>Reason</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
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<tr>
<td></td>
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</tr>
</tbody>
</table>
(f) 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

(g) We understand that you are not bound to accept the lowest evaluated bid or any other bid that you may receive.

(h) We agree to permit ADB 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 Bank.

(i) 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”**
PREAMBLE TO BILL OF QUANTITIES

1.0 INTRODUCTION

The Bill of Quantities (BOQ) shall be read in conjunction with the Instructions to Bidders, General Conditions of Contract, Particular Conditions of Contract, Technical Specifications, Bid Data Sheets and Drawings. The rates quoted shall be inclusive of cost of all materials, transportation and carriage of material up to works site, labour, plant and equipment, tools and tackles, safety gadgets, incidental etc. as may be required for that particular item in the BOQ which is to be read in conjunction in the specification.

The quantities given in the Bill of Quantities are estimated and provisional, and are given to provide a common basis for bidding. The basis of payment will be on the actual quantities of work ordered and carried out, as measured by the Contractor and verified by the Engineer and valued at the rates and prices tendered in the priced Bill of Quantities. If such rates are not available in the Bill of Quantities, this will be treated as extra work and such rates and prices will be fixed by the Engineer / Project Manager as per the terms of the Contract.

Mode of measurement, if not specified elsewhere shall be followed as per available codes of practice published by the Bureau of Indian Standards (BIS).

The rates and prices tendered in the priced Bill of Quantities shall, except insofar as it is otherwise provided under the contract, include all temporary facilities, access, notices to maintain traffic prevailing in an accessible manner, as far as possible for similar flow existing and also including all construction of plant, labour, supervision, materials, erection, maintenance, insurance, overhead, profit, taxes and duties together with all general risk, liabilities and obligation set out or implied in the contract.

General directions and descriptions of work and materials are not necessarily repeated or summarized in the Bill of Quantities. The Bidder must refer to the relevant sections of the bid documents including specifications, data sheets and drawings before quoting rates or prices against each item in the Bill of Quantities.

Provisional Sum, if included and so designated in the Bill of Quantities shall be expended in whole or in part at the direction and discretion of the Project Manager/ Engineer in accordance with the General Conditions of Contract. Payment for work under provisional item shall be payable for statutory requirement by other agencies viz. UPCL, UJS, PWD, Uttarakhand Police & specialized agencies or the like and for any unforeseen items of work. Payment for statutory requirement by the external agencies as above will be made as per bill raised by the other agency + 7.5% as Contractor’s service charges. However, approval of the agency and their rates shall be done jointly by the Engineer /
Project Manager. The amount kept under this head is as decided by the Project Manager and the Contractor shall not change this figure or quote of his own. The amount is subject to variation as per requirement of project with approval of the Project Manager.

Arithmetic errors will be corrected by the Employer as follows:

(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;

(c) if there is a discrepancy between the bid price in the Summary of Bill of Quantities and the bid amount in item (c) of the Letter of Bid, the bid price in the Summary of Bill of Quantities will prevail and the bid amount in item (c) of the Letter of Bid will be corrected; and

(d) 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), (b) and (c) above.

2.0 GENERAL

2.1 General Basis for Pricing

2.1.1 The Bidder shall be deemed to have read and examined the Bid Documents as well as inspected the project site thoroughly to conceive the work in totality to quote against each item of work as given in the BOQ.

2.1.2 The Bidder shall be deemed to be fully conversant with the site conditions and the nature and complexity of the work to be undertaken and taking into account all eventualities which can arise before, during and after project execution.

2.1.3 It is to be expressly understood that the measured work is to be taken net (not withstanding any system or practice to the contrary) according to the actual quantities finished according to the drawings or as may be ordered from time to time by the Engineer and the cost calculated for the respective prices.
2.1.4 Unless otherwise stated, all items shall be measured as executed as per drawing and specification and no allowance will be made for wastage, working space, bulking or shrinkage, and the like.

2.1.5 The Contractor shall have to establish as per requirement office at site with adequate space for their personnel, inclusive of necessary furniture & furnishing, computers with printers, consumables etc., storage space for equipment, materials etc. Contractor's quoted rates and price shall be inclusive of this and no separate payment will be made on this account.

2.1.6 The quoted rates and prices shall also be inclusive of communication system as per requirement to be established at site (telefax, internet facilities etc.), vehicles for movement at site etc. No extra cost against such items will be paid.

3.0 Miscellaneous

3.1 Temporary power connections, telephones, construction water shall be arranged by the Contractor at his own cost and shall be deemed to be included in their quoted rates. Alternative power arrangement shall be made by Contractor without any extra charge.

3.2 All underground and over ground utility items shall have to be suitably supported during the construction phase by the Contractor so that the existing utility services are not damaged. No extra payment will be made on this account.

3.3 The Contractor shall keep plumbers, technicians and electricians ready for repair/ shifting of existing underground/ over ground utilities and for crisis management.

3.4 During progress of work, convenient access to adjacent premises shall be made by the Contractor. No extra payment will be made on this account.

3.5 For speedy progress of work in case of exigency, while working along busy road etc., Contractor may have to do work round the clock at the instance of the Engineer/Project Manager. Arrangement for lighting and other safety requirements shall have to be done for night working. No extra payment shall be made to the Contractor except the items provided in the BOQ.

3.6 Temporary restoration of roads, as required, with excavated spoils will have to be done by the Contractor till permanent road is constructed and handed over. Temporary restoration shall be done as per instruction of Engineer and will be payable as per BOQ provision.

3.7 Dewatering item in BOQ will be applicable after finalization of the scheme and programme of pumping and with the Engineer.

3.8 The item rates quoted by the Contractor shall, unless otherwise specified, also include compliance of/ supply of the following:
   i) General works such as setting out, clearance of site before setting out and clearance of works after completion.
   ii) A detailed programme for the construction and completion of the work.
iii) Samples of various materials proposed to be used on the work for conducting tests thereon as required as per the provisions of the Contract and approved Quality Assurance Plan (QAP).

iv) Any other item of work which is not specially provided in the Bill of Quantities but which is necessary for complying with the provisions of the Contract.

v) All temporary works, formwork and false work.

vi) Arrange a laboratory with facilities for testing and testing of various items of works as specified in relevant clauses.


viii) Cost of labour hutment, site office.

ix) Cost of safeguarding the environment.

x) Cost of providing ‘as-built drawings’ in soft copy and hard copy in required numbers and preparation of O&M manual for any equipment furnished.

3.9 Extra items of work – If during the progress of work any extra items need to be carried out, which in the opinion of the Engineer/ Project Manager is essentially required to be executed, then the extra item shall be analyzed as follows:

i) Derived from rates of similar items of works stated in the tendered offer

ii) In the event an extra item of work that cannot be derived from (i) above, then the following shall be applicable.

The actual cost of materials based on documentation including labour, transportation, overhead and profit as per State PWD and / or CPWD norms.

The detailed BOQ is given in Volume – II of the Bid Document
ABSTRACT OF BILL OF QUANTITIES

NAME OF WORK: DEVELOPMENT OF TOURISM INFRASTRUCTURE IN KARTIKEYA SWAMI CIRCUIT (KARTIKEYA SWAMI TEMPLE)

G-schedule (SUMMARY OF KARTIKEYA SWAMI TEMPLE)

<table>
<thead>
<tr>
<th>S.No</th>
<th>Item Particulars</th>
<th>Amount (INR)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>In Figures</td>
</tr>
<tr>
<td>A</td>
<td>Civil Work</td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>Pathway</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Sitting Bench</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Railing at Temple Premises</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Renovation of Existing Dharamshala</td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>View Deck</td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>Small Toilet</td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>Renovation of Existing Toilet</td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td>Entrance Gate</td>
<td></td>
</tr>
<tr>
<td>9.</td>
<td>Big Toilet</td>
<td></td>
</tr>
<tr>
<td>10.</td>
<td>Renovation of Lodging Facility</td>
<td></td>
</tr>
<tr>
<td>11.</td>
<td>Furniture for Lodging Facility</td>
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</tr>
<tr>
<td>12.</td>
<td>Camping Site</td>
<td></td>
</tr>
<tr>
<td>13.</td>
<td>Renovation of Temple and Vyas Gufa</td>
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</tr>
<tr>
<td>14.</td>
<td>Directional Signage</td>
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<tr>
<td></td>
<td>Description</td>
<td>Amount</td>
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<tr>
<td>---</td>
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</tr>
<tr>
<td>15</td>
<td>Informative Display &amp; Publicity work</td>
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</tr>
<tr>
<td>16</td>
<td>Pathway Covering Shelter</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>Rest Shelter</td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>Retaining Wall &amp; Breast Wall</td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>Additional items</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>Fire Fighting Work</td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>Solar Lighting &amp; Solar Power Plant</td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>Electrical Work</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Total Amount (A)</strong></td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>Provisional Sum</td>
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</tr>
<tr>
<td>1</td>
<td>Water Supply Connection</td>
<td>500,000.00</td>
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<td>Five Lacs only.</td>
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<tr>
<td>2</td>
<td>Electricity Connection</td>
<td>500,000.00</td>
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<td></td>
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<td>Five Lacs only.</td>
</tr>
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<td>3</td>
<td>Rain Water Harvesting</td>
<td>9,28,000.00</td>
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<td>Nine Lacs Twenty Eight Thousand only.</td>
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<td>4</td>
<td>Hill View location pointer</td>
<td>1,00,000.00</td>
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<tr>
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<td><strong>Total Amount (B)</strong></td>
<td>2,028,000.00</td>
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<td><strong>Grand Total (A+B)</strong></td>
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</table>
### 1. PATHWAY

<table>
<thead>
<tr>
<th>S. N.</th>
<th>Item</th>
<th>Unit</th>
<th>Qty</th>
<th>Unit Rates (INR)</th>
<th>Amount (INR)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Providing and laying of stone set pavement over 2.5 cm thick bedding layer of PCC 1:1.5:3, which shall further be placed over 10 cm thick dry stone kharanja or crushed stones base over a prepared sub grade as per drawings and technical specifications. The size of stones shall not be less than 20 cm x 20 cm and thickness of stones shall vary from 10 cm to 15 cm. The work includes filling of joints with PCC 1:1.5:3 as per the standard drawings and instructions of the Engineer-in-Charge.</td>
<td>Sqm</td>
<td>2040.00</td>
<td>In Figures 2040.00</td>
<td>In Words</td>
</tr>
<tr>
<td>2</td>
<td>Providing and laying and making kerb channel 30cm wide and 50mm thick of cement concrete 1:3:6 (1 cement:3 coarse sand:6 graded stone aggregate 20mm nominal size) over 75mm bed of dry brick ballast 40 mm nominal size well rammed and consolidated and grouted with fine sand including finishing the top smooth etc. complete and as per direction of Engineer-in-charge.</td>
<td>Sqm</td>
<td>360.00</td>
<td>In Figures 360.00</td>
<td>In Words</td>
</tr>
<tr>
<td>3</td>
<td>Providing and laying at or near ground level factory made kerb stone of M-25 grade cement in position to the required line, level and curvature jointed with cement mortar 1:3 (1 cement: 3 coarse sand) including making joints with or without grooves (thickness of joints except at sharp curve shall not to more than 5mm) including making drainage opening wherever required complete etc. as per direction of Engineer-in-charge (length of finished kerb edging shall be measured for payment). (Precast C.C. kerb stone shall be approved by Engineer in charge).</td>
<td>Cum.</td>
<td>72.00</td>
<td>In Figures 72.00</td>
<td>In Words</td>
</tr>
</tbody>
</table>
1. Total Amount (in INR) – in figures

2. Total Amount (in INR) – in words

<table>
<thead>
<tr>
<th>S. N.</th>
<th>Item</th>
<th>Unit</th>
<th>Qty</th>
<th>Unit Rates (INR)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Earth work in excavation by mechanical means (Hydraulic Excavator) / manual means in foundation trenches or drains (not exceeding 1.5 m in width or 10 sqm on plan) including dressing of sides and ramming of bottoms, lift upto 1.5 m, including getting out the excavated soil and disposal of surplus excavated soil as directed, within a lead of 50 m. All kinds of soil.</td>
<td>Cum.</td>
<td>24.00</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Providing and laying in position cement concrete of specified grade excluding the cost of centring and shuttering - -All work upto plinth level 1:3:6 (1 Cement : 3 coarse sand : 6 graded stone aggregate 20 mm nominal size).</td>
<td>Cum.</td>
<td>6.00</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Centering shuttering including struttings, propping etc. and removal of form work for Foundations, footings, bases for columns.</td>
<td>Sqm</td>
<td>26.00</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Random rubble masonry with hard stone in foundation and plinth including levellingup with cement concrete 1:6:12 (1 cement: 6 coarse sand : 12 graded stone aggregate 20mm nominal size) at plinth level with Cement mortar 1:6 (1 cement : 6 coarse sand)</td>
<td>Cum.</td>
<td>32.06</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Providing and laying in position cement concrete of specified grade excluding the cost of centring and shuttering - -All work upto plinth level 1:2:4 (1 Cement : 2 coarse sand : 4 graded stone aggregate 20 mm nominal size)</td>
<td>Cum.</td>
<td>4.50</td>
<td></td>
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<tr>
<td>6</td>
<td>Centering shuttering including struttings, propping etc. and removal of form work for Retaining walls, return walls, walls (any thickness) including attached pilasters, buttresses, plinth and string courses fillets etc.</td>
<td>Sqm</td>
<td>19.50</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Kota stone slab flooring over 20 mm (average) thick base laid over and jointed with grey cement slurry mixed with pigment to match the shade of the slab including rubbing and polishing complete with base of cement mortar 1 : 4 (1 cement : 4 coarse sand) : 25 mm thick.</td>
<td>Sqm</td>
<td>60.00</td>
<td></td>
</tr>
</tbody>
</table>

1. **Total Amount (in INR) – in figures**

2. **Total Amount (in INR) – in words**
## 3. RAILING IN TEMPLE PREMISES

<table>
<thead>
<tr>
<th>S. N.</th>
<th>Item</th>
<th>Unit</th>
<th>Qty</th>
<th>Unit Rates (INR)</th>
<th>Amount (INR)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Earth work in excavation by mechanical means (Hydraulic Excavator) / manual means in foundation trenches or drains (not exceeding 1.5 m in width or 10 sqm on plan) including dressing of sides and ramming of bottoms, lift upto 1.5 m, including getting out the excavated soil and disposal of surplus excavated soil as directed, within a lead of 50 m. All kinds of soil.</td>
<td>Cum.</td>
<td>122.10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Providing and laying in position cement concrete of specified grade excluding the cost of centring and shuttering - All work upto plinth level 1:2:4 (1 cement : 2 coarse sand : 4 graded stone aggregate 20 mm nominal size)</td>
<td>Cum.</td>
<td>31.33</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Reinforcement for R.C.C. work including straightening, cutting, bending, placing in position and binding all complete. Reinforcement for R.C.C. Work Using Cold Twisted Bars</td>
<td>Kg.</td>
<td>2737.57</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Providing and laying in position specified grade of reinforced cement concrete excluding the cost of centring, shuttering, finishing and reinforcement - All work upto plinth level 1:1.5:3 (1 cement : 1.5 coarse sand : 3 graded stone aggregate 20 mm nominal size)</td>
<td>Cum.</td>
<td>17.34</td>
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<tr>
<td></td>
<td>Description</td>
<td>Unit</td>
<td>Quantity</td>
<td></td>
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<tr>
<td>5</td>
<td>Centering and shuttering for foundations, footings, bases of columns, etc. for mass concrete.</td>
<td>Sqm</td>
<td>174.20</td>
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<tr>
<td>6</td>
<td>Reinforced cement concrete work in walls (any thickness), including attached pilasters, buttresses, plinth and string courses, fillets, columns, pillars, piers, abutments, posts and struts etc. upto floor five level excluding cost of centring, shuttering, finishing and reinforcement 1:1.5:3 (1 cement : 1.5 coarse sand : 3 graded stone aggregate 20 mm nominal size)</td>
<td>Cum.</td>
<td>11.59</td>
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</tr>
<tr>
<td>7</td>
<td>Centering and shuttering including strutting, roping etc. and removal of form for Columns, Pillars, Piers, Abutments, Posts and Struts.</td>
<td>Sqm</td>
<td>204.08</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Reinforced cement concrete work in arches, archribs, domes, vaults, shells, folded plate and roofs having slope more than 15? up to floor five level excluding the cost of centering, shuttering, finishing and reinforcement with 1:2:4 (1 cement : 2 coarse sand : 4 graded stone aggregate 20 mm nominal size).</td>
<td>Cum.</td>
<td>1.32</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Centering and shuttering including strutting, roping etc. and removal of form for Arches, domes, vaults up to 6 m span</td>
<td>Sqm</td>
<td>52.92</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Coursed rubble masonry (first sort) with hard stone in foundation and plinth with Cement mortar 1:6 (1 cement: 6 coarse sand)</td>
<td>Cum.</td>
<td>67.57</td>
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<tr>
<td>No.</td>
<td>Description</td>
<td>Unit</td>
<td>Quantity</td>
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<tr>
<td>11</td>
<td>Structural steel work in single section fixed with or without connecting plate including cutting, hoisting, fixing in position and applying a priming coat of approved steel primer all complete.</td>
<td>Kg</td>
<td>4728.57</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Painting with synthetic enamel paint of approved brand and manufacture to give an even shade Two or more coats on new work</td>
<td>Sqm.</td>
<td>308.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Extra for plastering done on moulding cornices or architraves including neat finish In two coats</td>
<td>Sqm.</td>
<td>12.85</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Stone work in plain ashlar in super structure upto floor five level in cement mortar 1:6 (1 cement : 6 coarse sand) including pointing with cement mortar 1:2 (1 white cement: 2 stone dust) with an admixture of pigment matching the stone shade One face dressed. Red sand stone</td>
<td>Cum.</td>
<td>0.24</td>
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<tr>
<td>15</td>
<td>Pointing on stone work with cement mortar 1:3 (1 cement: 3 fine sand) Raised and cut pointing.</td>
<td>Sqm.</td>
<td>59.94</td>
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<tr>
<td>16</td>
<td>12 mm cement plaster finished with a floating coat of neat cement of mix 1:3 ( 1 cement : 3 fine sand)</td>
<td>Sqm.</td>
<td>167.16</td>
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</table>

1. **Total Amount (in INR) – in figures**

2. **Total Amount (in INR) – in words**
## 4. RENOVATION OF EXISTING DHARAMSHAL

<table>
<thead>
<tr>
<th>S. N.</th>
<th>Item</th>
<th>Unit</th>
<th>Qty</th>
<th>Unit Rates (INR)</th>
<th>Amount (INR)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Cement concrete flooring 1:2:4 (1 cement: 2 coarse sand : 4 graded stone aggregate) finished with a floating coat of neat cement including cement slurry, but excluding the cost of nosing of steps etc. complete 40mm thick with 20mm nominal size stone aggregate.</td>
<td>Sqm</td>
<td>120.35</td>
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<tr>
<td></td>
<td>Providing and fixing ISI marked flush door shutters conforming to IS: 2202 (Part I)non-decorative type, core of block board construction with frame of 1st class hard wood and well matched commercial 3 ply veneering with vertical grains or cross bands and face veneers on both faces of shutters 35 mm thick including ISI marked Stainless Steel butt hinges with necessary screws.</td>
<td>Sqm</td>
<td>10.08</td>
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<tr>
<td></td>
<td>20 mm cement plaster of mix 1:6 (1 cement: 6 coarse sand)</td>
<td>Sqm</td>
<td>221.76</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Wall lining butch work upto 10m height with red/white sand stone 40 mm thick rough facing on the exposed surface with stone strips of minimum length 300 mm and required width including embedding every tenth layer and bottom most layer in masonry or concrete after making necessary chases of size 75x75mm and by providing layer of 75mm thick strips i/c 12mm thick bed of cement mortar 1:3 (1 Cement : 3 coarse sand) i/c ruled</td>
<td>Sqm.</td>
<td>190.10</td>
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<td></td>
<td>Description</td>
<td>Measurement</td>
<td>Quantity</td>
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<td>-------------</td>
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<tr>
<td>5</td>
<td>Pointing in cement mortar 1:2 (1 white cement : 2 stone dust) with an admixture of pigment to match the shade of stone complete as per direction of Engineer-in-charge.</td>
<td>Cum.</td>
<td>1.21</td>
<td></td>
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<tr>
<td>6</td>
<td>Coursed rubble masonry (first sort) with hard stone in foundation and plinth with Cement mortar 1:6 (1 cement: 6 coarse sand)</td>
<td>Kg</td>
<td>534.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Structural steel work in single section fixed with or without connecting plate including cutting, hoisting, fixing in position and applying a priming coat of approved steel primer all complete.</td>
<td>Sqm</td>
<td>221.76</td>
<td></td>
<td></td>
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<tr>
<td>8</td>
<td>Colour washing such as green, blue or buff to give an even shade New work (two or more coats) with a base coat of white washing with lime</td>
<td>Sqm</td>
<td>221.76</td>
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<tr>
<td>9</td>
<td>Distempering with oil bound washable distemper of approved brand and manufacture to give an even shade New work (two or more coats) over and including priming coat with cement primer</td>
<td>Sqm</td>
<td>179.34</td>
<td></td>
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<td></td>
<td>Providing and fixing PUF Insulated continuous sandwich panels for Roofing of total thickness not less than 40 mm and width 1.0 m made out from continue line method on automatic plant. Panel shall have pre coated GI sheet on both side of Polyurethane Foam confirming to IS 12436:1988. The Precoated sheet shall be of minimum 240 mpa steel grade confirming to IS 14246:1995 and shall have zinc coating of minimum 120 gsm as per IS:277:1992, 5-7 microns epoxy primer on both side of the sheet and polyester top coat 15-18 micron. The PPGI Sheet shall have plastic protective guard film of minimum</td>
<td>Sqm</td>
<td>179.34</td>
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<td></td>
<td>Description</td>
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<td></td>
<td>25 microns to avoid scratches during transportation. The panels shall be vertically joined together by tongue and groove joints. The PU Foam shall be self-extinguishing, fire retardant type having minimum density of 40 Kg/Cu.mt.(+/- 2 Kgs) including 0.25 mm thick craft paper edging on both edges. The panels shall be fixed to the steel frame structure with minimum 5mm thick self tapping GI screws of required length and nos. with minimum spacing of 300 mm c/c complete in all respects. PPGI sheet 0.5 mm thick skin on both sides</td>
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<tr>
<td>10</td>
<td>Diluting and injecting chemical emulsion for POST-CONSTRUCTIONAL anti-termite treatment (including the cost of chemical emulsion). Treatment of soil under existing floors using chemical emulsion @ one litre per hole, 300 mm apart including drilling 12 mm diameter holes and plugging with cement mortar 1:2 (1 cement : 2 Coarse sand) to match the existing floor With Chlorpyriphos/ Lindane E.C. 20% with 1% concentration.</td>
<td>Sqm</td>
<td>138.55</td>
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<tr>
<td>11</td>
<td>Demolishing cement concrete manually/ by mechanical means including disposal of material within 50 metres lead as per direction of Engineer in charge. 1:3:6 or richer mix</td>
<td>Cum.</td>
<td>22.05</td>
<td></td>
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<tr>
<td>12</td>
<td>Demolishing stone rubble masonry manually/ by mechanical means including stacking of serviceable material and disposal of unserviceable material within 50 metres lead as per direction of Engineer-in-charge in cement mortar</td>
<td>Cum.</td>
<td>10.80</td>
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<td></td>
<td>Description</td>
<td>Unit</td>
<td>Amount</td>
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<tr>
<td>13</td>
<td>Removing mortar from and cleaning stones and concrete articles (net quantity of stacks of cleaned material will be measured): In cement mortar</td>
<td>Cum.</td>
<td>10.80</td>
<td></td>
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</tr>
<tr>
<td>14</td>
<td>Dismantling old plaster or skirting raking out joints and cleaning the surface for plaster including disposal of rubbish to the dumping ground within 50 metres lead.</td>
<td>Sqm.</td>
<td>147.00</td>
<td></td>
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<tr>
<td>15</td>
<td>Dismantling steel work in built up sections in angles, tees, flats and channels including all gusset plates, bolts, nuts, cutting rivets, welding etc. including dismembering and stacking within 50metres lead.</td>
<td>Kg</td>
<td>1102.50</td>
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<tr>
<td>16</td>
<td>Extra for dismantling trusses, rafters, purlins etc. of steel work for every additional span of one metre or part thereof beyond 10 metres.</td>
<td>Kg</td>
<td>2572.50</td>
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</table>

1. **Total Amount (in INR) – in figures**

2. **Total Amount (in INR) – in words**
### 5. VIEW DECK

<table>
<thead>
<tr>
<th>S. N.</th>
<th>Item</th>
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<th>Qty</th>
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<th>Amount (INR)</th>
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<td>In Figures</td>
<td>In Words</td>
</tr>
<tr>
<td>1</td>
<td>Earth work in excavation by mechanical means (Hydraulic excavator)/</td>
<td>Cum.</td>
<td>36.30</td>
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<td></td>
<td>manual means over areas (exceeding 30cm in depth, 1.5m in width as</td>
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<td></td>
<td>well as 10 sqm on plan) including disposal of excavated earth, lead</td>
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<td></td>
<td>upto 50m and lift upto 1.5m, disposed earth to be levelled and neatly</td>
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<td></td>
<td>dressed. Excavation in all kinds of soil</td>
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<tr>
<td>2</td>
<td>Providing and laying in position cement concrete of specified grade</td>
<td>Cum.</td>
<td>3.63</td>
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<tr>
<td></td>
<td>excluding the cost of centring and shuttering - All work upto plinth</td>
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<td></td>
<td>level 1:3:6 (1 Cement : 3 coarse sand : 6 graded stone aggregate</td>
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<td></td>
<td>20 mm nominal size)</td>
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<tr>
<td>3</td>
<td>Centring and shuttering for foundations, footings, bases of columns,</td>
<td>Sqm</td>
<td>70.80</td>
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<td></td>
<td>etc. for mass concrete</td>
<td></td>
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<td>4</td>
<td>Providing and laying in position specified grade of reinforced</td>
<td>Cum.</td>
<td>11.66</td>
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<td></td>
<td>cement concrete excluding the cost of centring, shuttering, finishing</td>
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<td></td>
<td>and reinforcement - All work upto plinth level 1:1.5:3 (1 cement :</td>
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<td></td>
<td>1.5 coarse sand : 3 graded stone aggregate 20 mm nominal size)</td>
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<tr>
<td>5</td>
<td>Reinforcement for R.C.C. work including straightening, cutting,</td>
<td>Kg.</td>
<td>304.68</td>
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<td></td>
<td>bending, placing in position and binding all complete. Reinforcement</td>
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<td>for R.C.C. Work Using Cold Twisted Bars</td>
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<td>Description</td>
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<tr>
<td>6</td>
<td>Supplying and stacking of hard stone (for stone pitching) 22.5 cm thick at site</td>
<td>Cum</td>
<td>14.58</td>
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<tr>
<td>7</td>
<td>Dry stone pitching 22.5cm thick laid in courses and required profile with hammer dressed stones having no side less than 15 cm, with minimum depth of 20cm including preparing the bedding surface etc. all complete. (Payment for Stone to be made separately)</td>
<td>Sqm</td>
<td>64.80</td>
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<tr>
<td>8</td>
<td>Providing and laying cement concrete in retaining walls, return walls (any thickness) including attached pilasters, columns, piers, abutments, pillars, posts, struts, buttresses, string or lacing courses, parapets, coping bed blocks, anchor blocks, plain window sills, fillets etc upto floor five level, excluding the cost of centring, shuttering and finishing 1:2:4 (1 Cement : 2 coarse sand : 4 graded stone aggregate 20 mm nominal size).</td>
<td>Cum</td>
<td>9.72</td>
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<tr>
<td>9</td>
<td>Providing and fixing hand rail of approved size by welding etc. to steel ladder railing, balcony railing and staircase railing including applying a priming coat of approved steel primer. M.S. tube</td>
<td>Kg.</td>
<td>925.71</td>
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<tr>
<td>10</td>
<td>Painting with synthetic enamel paint of approved brand and manufacture to give an even shade Two or more coats on new work</td>
<td>Sqm</td>
<td>109.29</td>
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<tr>
<td>11</td>
<td>Finished decorative work on railing, plate fixing in all respect as per drawing</td>
<td>Job</td>
<td>5.00</td>
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</tbody>
</table>

1. Total Amount (in INR) – in figures

2. Total Amount (in INR) – in words
### 6. SMALL TOILET

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<tr>
<th>S. N.</th>
<th>Item</th>
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<th>Qty</th>
<th>Unit Rates (INR)</th>
<th>Amount (INR)</th>
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<tr>
<td>1</td>
<td>Earth work in surface excavation not exceeding 30 cm in depth but exceeding 1.5 m in width as well as 10 sqm on plan including disposal of excavated earth upto 50 m and lift upto 1.5 m, disposed soil to be levelled and neatly dressed.</td>
<td>Sqm.</td>
<td>36.00</td>
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<tr>
<td>2</td>
<td>Diluting and injecting chemical emulsion (Chlorpyriphos/Lindane E.C. 20% with 1% concentration), at the rate of one litre per hole at 300 mm c/c to all the horizontal and vertical surfaces of the excavations made for the foundation of the building, soil under floors, apron, back fill material and along all the faces of the walls for PRE-CONSTRUCTIONAL anti-termite treatment (including the cost of chemical emulsion) as per IS: 6313 Part-II. (Plinth area of Building shall be measured for Payment).</td>
<td>Sqm.</td>
<td>21.21</td>
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<tr>
<td>3</td>
<td>Earth work in excavation by mechanical means (Hydraulic Excavator )/ manual means in foundation trenches or drains (not exceeding 1.5 m in width or 10 sqm on plan) including dressing of sides and ramming of bottoms, lift upto 1.5 m, including getting out the excavated soil and disposal of surplus excavated soil as directed, within a lead of 50 m.</td>
<td>Cum.</td>
<td>65.92</td>
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<td></td>
<td>Description</td>
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<tr>
<td>4</td>
<td>Providing and laying in position cement concrete of specified grade excluding the cost of centring and shuttering - All work upto plinth level 1:3:6 (1 Cement : 3 coarse sand : 6 graded stone aggregate 20 mm nominal size).</td>
<td>Cum.</td>
<td>6.91</td>
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<tr>
<td>5</td>
<td>Reinforcement for R.C.C. works including straightening, cutting, bending, placing in position and binding all complete. Reinforcement for R.C.C. Work Using Cold Twisted Bars</td>
<td>Kg.</td>
<td>813.58</td>
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<tr>
<td>6</td>
<td>Providing and laying in position specified grade of reinforced cement concrete excluding the cost of centring, shuttering, finishing and reinforcement - All work upto plinth level 1:1.5:3 (1 cement : 1.5 coarse sand : 3 graded stone aggregate 20 mm nominal size)</td>
<td>Cum.</td>
<td>10.45</td>
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<tr>
<td>7</td>
<td>Centring and shuttering for foundations, footings, bases of columns, etc. for mass concrete.</td>
<td>Sqm.</td>
<td>20.88</td>
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<tr>
<td>8</td>
<td>Centering shuttering including struttings, propping etc. and removal of form work for Lintels, beams, plinth beams, girders, bressumers and cantilevers.</td>
<td>Sqm.</td>
<td>41.18</td>
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<tr>
<td>9</td>
<td>Centring and Shuttering for Suspended floors, roofs, landings, balconies and access platform.</td>
<td>Sqm.</td>
<td>20.03</td>
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<td>10</td>
<td>Brick work with F.P.S. bricks of class designation 75 in foundation and plinth in Cement mortar 1:6 (1 cement : 6 coarse sand)</td>
<td>Cum.</td>
<td>15.38</td>
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<tr>
<td>11</td>
<td>Structural steel work in single section fixed with or without connecting plate including cutting, hoisting, fixing in position and applying a priming coat of approved steel primer all complete.</td>
<td>Kg.</td>
<td>1726.34</td>
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<tr>
<td>12</td>
<td>Bolt 12mm for plate</td>
<td>Nos</td>
<td>48.00</td>
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<tr>
<td>13</td>
<td>Supplying and stacking at site. Good earth.</td>
<td>Cum.</td>
<td>2.25</td>
<td></td>
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<tr>
<td>14</td>
<td>Filling available excavated earth (excluding rock) in trenches, plinth, sides of foundations etc. in layers not exceeding 20cm in depth, consolidating each deposited layer by ramming and watering, lead up to 50 m and lift upto 1.5 m.</td>
<td>Cum.</td>
<td>2.25</td>
<td></td>
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<tr>
<td>15</td>
<td>Providing and fixing PUF Insulated continuous sandwich panels for Floor of total thickness not less than 40 mm and width 1.0 m made out from continue line method on automatic plant. Panel shall have pre coated GI sheet on both side of Polyurethane Foam confirming to IS 12436:1988. The Precoated sheet shall be of minimum 240 mpa steel grade confirming to IS 14246:1995 and shall have zinc coating of minimum 120 gsm as per IS:277:1992, 5-7 microns epoxy primer on both side of the sheet and polyester top coat 15-18 micron. The PPGI Sheet shall have plastic protective guard film of minimum 25 microns to avoid scratches during trasportation. The panels shall be vertically joined together by tongue and groove joints. The PU Foam shall be self-extinguishing, fire retardant type having minimum density of 40 Kg/Cu.mt.( +, - 2 Kgs) including 0.25 mm thick craft paper edging on both edges. The panels shall be fixed to the steel frame structure with minimum 5mm thick self tapping GI screws of required length and nos. with</td>
<td>Sqm</td>
<td>54.01</td>
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<tr>
<td>16</td>
<td>Black Sheet for Facia 2 mm thick G.S. Sheet @ 15.70 kg/Sqm</td>
<td>kg</td>
<td>102.87</td>
<td></td>
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<tr>
<td>17</td>
<td>Providing and fixing factory made UPVC door frame made of UPVC extruded, Extruded section Profile size 42x50 mm.</td>
<td>Rmt.</td>
<td>29.70</td>
<td></td>
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<tr>
<td>18</td>
<td>Providing and fixing to existing door frames. 30mm thick factory made solid panel PVC door shutter consisting of frame made out of M.S. tubes of 19 gauge thickness and size of 19mm x 19mm for stiles, top &amp; bottom rails. M.S .frame shall have a coat of steel primers of approved make and manufacture M.S. frame covered with 5mm thick heat moulded PVC 'C channel of size 30mm thickness, 110mm width out of which90mm shall be flat and 20mm shall be tapered in 45 degree angle on either side forming stiles; and 5mm thick, 110mm wide PVC sheet out of which 90mm shall be flat and 20mm shall be tapered on the inner side to form top and bottom rail and 130mm wide PVC sheet out of which 90mm shall be flat and 20mm shall be tapered on both sides to form lock rail. Top bottom and lock rails shall be provided either side of the panel. 10mm (5mm x 2) thick, 20mm wide cross PVC sheet shall be provided as gap insert for top rail &amp; bottom rail. Panelling of 5mm thick PVC sheet to be fitted in the M.S. frame welded/sealed to the stiles &amp; rails with 7mm (5mm +2mm) thick x 15mm wide PVC sheet bending on inner side, and joined together with solvent cement adhesive. An</td>
<td>Sqm.</td>
<td>9.45</td>
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<td>19</td>
<td>Providing and fixing White Vitreous China Wash Basin size 630x450 mm with a pair of 15 mm C.P. brass pillar taps.</td>
<td>6.00</td>
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<tr>
<td>20</td>
<td>Providing and fixing PTMT Bottle Trap for Wash basin and sink. Bottle trap 38mm single piece moulded with height of 270mm, effective length of tail pipe 260mm from the centre of the waste coupling 77mm breadth with 25mm minimum water seal, weighing not less than 263gms.</td>
<td>6.00</td>
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<tr>
<td>21</td>
<td>S/F C.I. Nahani (Floor) Trap</td>
<td>12.00</td>
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<td>22</td>
<td>S/F PVC P- Trap</td>
<td>6.00</td>
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<td>23</td>
<td>Providing and fixing soil, waste and vent pipes: 75 mm dia.Centrifugally cast (spun) iron socketed pipe as per IS: 3989.</td>
<td>30.00</td>
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<tr>
<td>24</td>
<td>Providing and fixing soil, waste and vent pipes: 100 mm dia.Centrifugally cast (spun) iron socketed pipe as per IS: 3989.</td>
<td>48.00</td>
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<td>25</td>
<td>Providing and fixing plain bend of required degree. 100 mm Sand cast iron S&amp;S as per IS – 1729</td>
<td>12.00</td>
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<td>26</td>
<td>Providing lead caulked joints to sand cast iron/centrifugally cast (spun) iron 75 mm</td>
<td>6.00</td>
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<tr>
<td>27</td>
<td>Providing lead caulked joints to sand cast iron/centrifugally cast (spun) iron 100 mm</td>
<td>6.00</td>
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<tr>
<td>28</td>
<td>Providing and fixing water closet squatting pan (Indian type W.C. pan ) with 100mm White Vitreous china Orissa pattern W.C. pan of size 580x440mm with integral type foot rests.</td>
<td>6.00</td>
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<td>29</td>
<td>Providing and fixing square-mouth S.W. gully trap grade 'A'' complete with C.I. grating brick masonry chamber with water tight C.I. cover with frame of 300 x300 mm size (inside) the weight of cover to be not less than 4.50 kg and frame to be not less than 2.70 kg as per standard design : 100x100 mm size P type With F.P.S. Bricks class designation 75</td>
<td>6.00</td>
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<td>30</td>
<td>Providing and fixing mirror of superior glass (of approved quality) and of Rectangular shape 1500x450 mm</td>
<td>6.00</td>
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<td>31</td>
<td>Providing and fixing C.P. brass angle valve for basin mixer and geyser points of approved quality conforming to IS:8931 15 mm nominal bore</td>
<td>6.00</td>
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<td>Item</td>
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<td>32</td>
<td>Providing and fixing toilet paper holder: C.P. brass</td>
<td>No.</td>
<td>6.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>33</td>
<td>Providing and fixing PTMT towel rail complete with brackets fixed to wooden 600mm long towel rail with total length of 645mm, width 78mm and effective height of 88mm, weighing not less than 190gms.</td>
<td>No.</td>
<td>6.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>34</td>
<td>Providing and fixing PTMT liquid soap container 109mm wide, 125mm high and 112mm distance from wall of standard shape with bracket of the same materials with snap fittings of approved quality and colours weighing not less than 105 gms</td>
<td>No.</td>
<td>6.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>35</td>
<td>Providing and fixing C.P. brass bib cock of approved quality conforming to IS:8931 15 mm nominal bore</td>
<td>No.</td>
<td>6.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>36</td>
<td>Providing and fixing P.V.C. low level flushing cistern with manually controlled device 10 litre capacity-White</td>
<td>No.</td>
<td>6.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>37</td>
<td>Providing and laying Ceramic glazed floor tiles 300 x 300 mm (thickness to be specified by the manufacturer) of 1st quality conforming to IS:15622 of approved make in colours such as White, Ivory, Grey, Fume, Red Brown, laid on 20 mm thick Cement Mortar 1:4 (1 Cement : 4 Coarse sand) including pointing the joints with white cement and matching pigment etc., complete.</td>
<td>Sqm.</td>
<td>15.00</td>
<td></td>
<td></td>
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<tr>
<td>No.</td>
<td>Description</td>
<td>Unit</td>
<td>Quantity</td>
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<tr>
<td>38</td>
<td>Providing and fixing 1st quality ceramic glazed wall tiles conforming to IS : 15622 (thickness to be specified by the manufacture) of approved make in all colours, shades except burgundy, bottle green, black of any size as approved by Engineer-in-Charge in skirting, risers of steps and dados over 12 mm thick bed of cement Mortar 1:3 (1 cement : 3 coarse sand) and jointing with grey cement slurry @ 3.3kg per sqm including pointing in white cement mixed with pigment of matching shade complete.</td>
<td>Sqm</td>
<td>62.32</td>
<td></td>
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<tr>
<td>39</td>
<td>Cement plaster 1:3 (1 cement: 3 coarse sand) finished with a floating coat of neat cement. 20 mm cement plaster</td>
<td>Sqm</td>
<td>56.63</td>
<td></td>
<td></td>
</tr>
<tr>
<td>40</td>
<td>Making soak pit 2.5 m diameter 3.0 metre deep with 45 x 45 cm dry brick honey With F.P.S. bricks</td>
<td>No.</td>
<td>3.00</td>
<td></td>
<td></td>
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<tr>
<td>41</td>
<td>Providing, laying and jointing glazed stoneware pipes grade ‘A’ with stiff mixture 100 mm diameter</td>
<td>Rmt.</td>
<td>45.00</td>
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<tr>
<td>42</td>
<td>Providing and laying cement concrete 1:5:10 (1 cement : 5 coarse sand : 10 graded 100 mm diameter S.W. pipe</td>
<td>Rmt.</td>
<td>45.00</td>
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<tr>
<td>43</td>
<td>Providing and fixing G.I pipes complete with G.I. fittings including trenching and refilling etc.(external work) 40 mm dia nominal bore</td>
<td>Rmt</td>
<td>600.00</td>
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<tr>
<td>44</td>
<td>Providing and fixing G.I pipes complete with G.I. fittings including trenching and refilling etc.(external work)</td>
<td>Rmt</td>
<td>45.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No.</td>
<td>Description</td>
<td>Unit</td>
<td>Quantity</td>
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<tr>
<td>45</td>
<td>Providing and fixing G.I pipes complete with G.I. fittings and clamps, including cutting and making good the walls etc. internal work- Exposed on wall 15 mm dia nominal bore</td>
<td>Rmt</td>
<td>45.00</td>
<td></td>
<td></td>
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<tr>
<td>46</td>
<td>Providing &amp; Fixing BIO-DIGESTIBLE tank for Toilets</td>
<td>Nos</td>
<td>3.00</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. **Total Amount (in INR) – in figures**

2. **Total Amount (in INR) – in words**
### 7. RENOVATION OF EXISTING TOILET

<table>
<thead>
<tr>
<th>S. N.</th>
<th>Item</th>
<th>Unit</th>
<th>Qty</th>
<th>Unit Rates (INR)</th>
<th>Amount (INR)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Providing and laying Ceramic glazed floor tiles 300 x 300 mm (thickness to be specified by the manufacturer) of 1st quality conforming to IS :15622 of approved make in colours such as White, Ivory, Grey, Fume, Red Brown, laid on 20 mm thick Cement Mortar 1:4 (1 Cement : 4 Coarse sand) including pointing the joints with white cement and matching pigment etc., complete.</td>
<td>Sqm.</td>
<td>3.84</td>
<td></td>
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</tr>
<tr>
<td>2</td>
<td>Providing and fixing Ist quality ceramic glazed wall tiles conforming to IS : 15622 (thickness to be specified by the manufacture ) of approved make in all colours, shades except burgundy, bottle green, black of any size as approved by Engineer-in-Charge in skirting, risers of steps and dados over 12 mm thick bed of cement Mortar 1:3 (1 cement : 3 coarse sand) and jointing with grey cement slurry @ 3.3kg per sqm including pointing in white cement mixed with pigment of matching shade complete.</td>
<td>Sqm.</td>
<td>25.41</td>
<td></td>
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<tr>
<td>3</td>
<td>Providing and fixing pressed steel door frames confirming to IS: 4351 manufactured from commercial mild steel sheet of 1.25 mm thickness including hinges jamb, lock jamb, bead and if required angle threshold of mild steel angle of section 50x25mm, or base ties of 1.25mm</td>
<td>Kg</td>
<td>34.65</td>
<td></td>
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<td></td>
<td>Description</td>
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<tr>
<td>3</td>
<td>pressed mild steel welded or rigidly fixed together by mechanical means, adjustable lugs with split end tail to each jamb including steel butt hinges 2.5mm thick with mortar guards, lock strike-plate and shock absorbers as specified and applying a coat of approved steel primer after pre-treatment of the surface as directed by Engineer-in-charge. Profile E Fixing with carbon steel galvanised dash fastener of required dia and size (to be paid metre for separately).</td>
<td>Sqm</td>
<td>3.15</td>
<td></td>
<td></td>
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<tr>
<td>4</td>
<td>Providing and fixing ISI marked flush door shutters conforming to IS: 2202 (Part I) non-decorative type, core of block board construction with frame of 1st class hard wood and well matched commercial 3 ply veneering with vertical grains or cross bands and face veneers on both faces of shutters 35 mm thick including ISI marked Stainless Steel butt hinges with necessary screws.</td>
<td>Sqm</td>
<td>3.15</td>
<td></td>
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<tr>
<td>5</td>
<td>Wall lining butch work upto 10m height with red/white sand stone 40 mm thick rough facing on the exposed surface with stone strips of minimum length 300 mm and required width including embedding every tenth layer and bottom most layer in masonry or concrete after making necessary chases of size 75x75mm and by providing layer of 75mm thick strips i/c 12mm thick bed of cement mortar 1:3 (1 Cement : 3 coarse sand) i/c ruled pointing in cement mortar 1:2 (1 white cement : 2 stone dust) with an admixture of pigment to match the shade of stone complete as per direction of Engineer-in-charge.</td>
<td>Sqm.</td>
<td>22.05</td>
<td></td>
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<tr>
<td>No.</td>
<td>Description</td>
<td>Unit</td>
<td>Quantity</td>
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<tr>
<td>6</td>
<td>12 mm cement plaster of mix 1:6 (1 cement : 6 coarse sand)</td>
<td>Sqm.</td>
<td>5.85</td>
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<tr>
<td>7</td>
<td>Grading roof for water proofing treatment with Grading roof for water proofing treatment with Cement concrete 1:2:4 (1 cement : 2 coarse sand : 4 graded stone aggregate 20 mm nominal size)</td>
<td>Cum</td>
<td>0.73</td>
<td></td>
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<tr>
<td>8</td>
<td>Providing and fixing White Vitreous China Wash Basin size 630x450 mm with a pair of 15 mm C.P. brass pillar taps.</td>
<td>No.</td>
<td>2.00</td>
<td></td>
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<tr>
<td>9</td>
<td>Providing and fixing PTMT Bottle Trap for Wash basin and sink. Bottle trap 38mm single piece moulded with height of 270mm, effective length of tail pipe 260mm from the centre of the waste coupling 77mm breadth with 25mm minimum water seal, weighing not less than 263gms.</td>
<td>No.</td>
<td>2.00</td>
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<tr>
<td>10</td>
<td>S/F C.I. Nahani (Floor) Trap</td>
<td>No.</td>
<td>4.00</td>
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<td></td>
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<tr>
<td>11</td>
<td>Providing and fixing water closet squatting pan (Indian type W.C. pan ) with 100mm White Vitreous china Orissa pattern W.C. pan of size 580x440mm with integral type foot rests.</td>
<td>No.</td>
<td>2.00</td>
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<tr>
<td>12</td>
<td>Providing and fixing mirror of superior glass (of approved quality) and of Rectangular shape 1500x450 mm</td>
<td>No.</td>
<td>2.00</td>
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<td></td>
<td>Description</td>
<td>No.</td>
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<tr>
<td>13</td>
<td>Providing and fixing C.P. brass angle valve for basin mixer and geyser points of approved quality conforming to IS:8931 15 mm nominal bore</td>
<td>2.00</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>14</td>
<td>Providing and fixing PTMT liquid soap container 109mm wide, 125mm high and 112mm distance from wall of standard shape with bracket of the same materials with snap fittings of approved quality and colours weighing not less than 105 gms</td>
<td>2.00</td>
<td></td>
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<tr>
<td>15</td>
<td>Providing and fixing C.P. brass bib cock of approved quality conforming to IS:8931 15 mm nominal bore</td>
<td>2.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>Providing and fixing P.V.C. low level flushing cistern with manually controlled device 10 litre capacity-White</td>
<td>2.00</td>
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1. Total Amount (in INR) – in figures

2. Total Amount (in INR) – in words
8. ENTRANCE GATE

<table>
<thead>
<tr>
<th>S. N.</th>
<th>Item</th>
<th>Unit</th>
<th>Qty</th>
<th>Unit Rates (INR)</th>
<th>Amount (INR)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Earth work in excavation by mechanical means (Hydraulic excavator)/</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>manual means over areas (exceeding 30cm in depth. 1.5m in width as</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>well as 10 sqm on plan) including disposal of excavated earth, lead</td>
<td></td>
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<tr>
<td></td>
<td>upto 50m and lift upto 1.5m, disposed earth to be levelled and neatly</td>
<td></td>
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<tr>
<td></td>
<td>dressed. Excavation in all kinds of soil.</td>
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<td></td>
<td></td>
<td>Cum.</td>
<td>17.28</td>
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<td>Description</td>
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<td>Quantity</td>
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<tr>
<td>2</td>
<td>Providing and laying in position cement concrete of specified grade excluding the cost of centring and shuttering - All work upto plinth level 1:3:6 (1 Cement : 3 coarse sand : 6 graded stone aggregate 20 mm nominal size).</td>
<td>Cum.</td>
<td>2.88</td>
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<tr>
<td>3</td>
<td>Centring and shuttering for foundations, footings, bases of columns, etc. for mass concrete.</td>
<td>Sqm</td>
<td>46.95</td>
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<tr>
<td>4</td>
<td>Providing and laying in position specified grade of reinforced cement concrete excluding the cost of centring, shuttering, finishing and reinforcement - All work upto plinth level 1:1.5:3 (1 cement : 1.5 coarse sand : 3 graded stone aggregate 20 mm nominal size)</td>
<td>Cum.</td>
<td>12.98</td>
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<tr>
<td>5</td>
<td>Reinforced cement concrete work in walls (any thickness), including attached pilasters, buttresses, plinth and string courses, fillets, columns, pillars, piers, abutments, posts and struts etc. upto floor five level excluding cost of centring, shuttering, finishing and reinforcement 1:1:2 (1 cement: 1 coarse sand : 2 graded stone aggregate 20 mm nominal size)</td>
<td>Cum.</td>
<td>53.76</td>
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<td>6</td>
<td>Centring and shuttering including strutting, roping etc. and removal of form for Arches, domes, vaults up to 6 m span &amp; Cornices and mouldings</td>
<td>Sqm</td>
<td>139.50</td>
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<td>7</td>
<td>Reinforcement for R.C.C. work including straightening, cutting, bending, placing in position and binding all complete. Reinforcement for R.C.C. Work Using Cold Twisted Bars.</td>
<td>Kg.</td>
<td>807.12</td>
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<tr>
<td>S. N.</td>
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</tr>
<tr>
<td>8</td>
<td>Finishing work with neat cement munnins, moulding work, cement primer painting work on complete work.</td>
<td>Job</td>
<td>5.00</td>
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<tr>
<td>9</td>
<td>Providing and Fixing Cast iron Ornamental (Heritage) Bluster and Flower on bluster as directed by Engineer In-charge</td>
<td>Kg</td>
<td>239.00</td>
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<tr>
<td>10</td>
<td>Providing and Fixing Cast iron Decorative Kartikeyswami Idol for entrance gate as directed by Engineer In-charge</td>
<td>Nos</td>
<td>5.00</td>
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</tbody>
</table>

1. Total Amount (in INR) – in figures

2. Total Amount (in INR) – in words

9. BIG TOILET

<table>
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<tr>
<th>S. N.</th>
<th>Item</th>
<th>Unit</th>
<th>Qty</th>
<th>Unit Rates (INR)</th>
<th>Amount (INR)</th>
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<tr>
<td></td>
<td>Description</td>
<td>Measurement</td>
<td>Price</td>
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<tr>
<td>1</td>
<td>Earth work in surface excavation not exceeding 30 cm in depth but exceeding 1.5 m in width as well as 10 sqm on plan including disposal of excavated earth upto 50 m and lift upto 1.5 m, disposed soil to be levelled and neatly dressed.</td>
<td>Sqm. 48.00</td>
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<tr>
<td>2</td>
<td>Diluting and injecting chemical emulsion (Chlorpyriphos/Lindane E.C. 20% with 1% concentration), at the rate of one litre per hole at 300 mm c/c to all the horizontal and vertical surfaces of the excavations made for the foundation of the building, soil under floors, apron, back fill material and along all the faces of the walls for PRE-CONSTRUCTIONAL anti-termite treatment (including the cost of chemical emulsion) as per IS: 6313 Part-II. (Plinth area of Building shall be measured for Payment).</td>
<td>Sqm. 36.00</td>
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<tr>
<td>3</td>
<td>Earth work in excavation by mechanical means (Hydraulic Excavator )/ manual means in foundation trenches or drains (not exceeding 1.5 m in width or 10 sqm on plan) including dressing of sides and ramming of bottoms, lift upto 1.5 m, including getting out the excavated soil and disposal of surplus excavated soil as directed, within a lead of 50 m.</td>
<td>Cum. 37.37</td>
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<td>4</td>
<td>Providing and laying in position cement concrete of specified grade excluding the cost of centring and shuttering - -All work upto plinth level 1:3:6 (1 Cement : 3 coarse sand : 6 graded stone aggregate 20 mm nominal size).</td>
<td>Cum. 4.73</td>
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<tr>
<td>5</td>
<td>Centering shuttering including struttings, propping etc. and removal of form work for Foundations,</td>
<td>Sqm. 7.86</td>
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</tr>
<tr>
<td></td>
<td>Description</td>
<td>Unit</td>
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<tr>
<td></td>
<td>footings, bases for columns.</td>
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</tr>
<tr>
<td>6</td>
<td>Reinforcement for R.C.C. work including straightening, cutting, bending, placing in position and binding all complete. Reinforcement for R.C.C. Work Using Cold Twisted Bars</td>
<td>Kg.</td>
<td>726.99</td>
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<tr>
<td>7</td>
<td>Providing and laying in position specified grade of reinforced cement concrete excluding the cost of centring, shuttering, finishing and reinforcement - All work upto plinth level 1:1.5:3 (1 cement : 1.5 coarse sand : 3 graded stone aggregate 20 mm nominal size)</td>
<td>Cum.</td>
<td>10.04</td>
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<td>8</td>
<td>Centring and shuttering for foundations, footings, bases of columns, etc. for mass concrete.</td>
<td>Sqm.</td>
<td>43.86</td>
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<tr>
<td>9</td>
<td>Centering shuttering including strutting, propping etc. and removal of form work for Lintels, beams, plinth beams, girders, bressumers and cantilevers.</td>
<td>Sqm.</td>
<td>31.44</td>
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<tr>
<td>10</td>
<td>Centring and Shuttering for Suspended floors, roofs, landings, balconies and access platform.</td>
<td>Sqm.</td>
<td>6.68</td>
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<tr>
<td>11</td>
<td>Brick work with F.P.S. bricks of class designation 75 in foundation and plinth in Cement mortar 1:6 (1 cement : 6 coarse sand)</td>
<td>Cum.</td>
<td>5.13</td>
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<tr>
<td>12</td>
<td>Structural steel work in single section fixed with or without connecting plate including cutting, hoisting, fixing in position and applying a priming coat of approved steel primer all complete.</td>
<td>Kg</td>
<td>1262.42</td>
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<tr>
<td>13</td>
<td>Bolt 12mm for plate</td>
<td>Nos</td>
<td>36.00</td>
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<td>14</td>
<td>Supplying and stacking at site. Good earth.</td>
<td>Cum.</td>
<td>6.86</td>
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</tr>
<tr>
<td>15</td>
<td>Banking excavated earth in layers not exceeding 20 cm. in depth, breaking clods, watering, rolling each layer with ½ tonne roller, or wooden or steel rammers, and rolling every 3rd and top-most layer with power roller of minimum 8 tonnes and dressing up, in embankments for roads, flood banks, marginal banks, and guide banks etc., lead upto 50 m and lift upto 1.5 m.</td>
<td>Cum.</td>
<td>6.86</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>Providing and fixing PUF Insulated continuous sandwich panels for Floor of total thickness not less than 40 mm and width 1.0 m made out from continue line method on automatic plant. Panel shall have pre coated GI sheet on both side of Polyurethane Foam confirming to IS 12436:1988. The Precoated sheet shall be of minimum 240 mpa steel grade confirming to IS 14246:1995 and shall have zinc coating of minimum 120 gsm as per IS:277:1992, 5-7 microns epoxy primer on both side of the sheet and polyester top coat 15-18 micron. The PPGI Sheet shall have plastic protective guard film of minimum 25 microns to avoid scratches during trasportation. The panels shall be vertically joined together by tongue and groove joints. The PU</td>
<td>Sqm.</td>
<td>52.02</td>
<td></td>
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<td></td>
<td>Description</td>
<td>Unit</td>
<td>Quantity</td>
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<td>17</td>
<td>Foam shall be self-extinguishing, fire retardant type having minimum density of 40 Kg/Cu.mt. (+, - 2 Kgs) including 0.25 mm thick craft paper edging on both edges. The panels shall be fixed to the steel frame structure with minimum 5mm thick self tapping GI screws of required length and nos. with minimum spacing of 300 mm c/c complete in all respects. PPGI sheet 0.5 mm thick skin on both sides</td>
<td>kg</td>
<td>66.41</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>Black Sheet for Facia 2 mm thick G.S. Sheet @ 15.70 kg/Sqm</td>
<td>kg</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>19</td>
<td>Providing and fixing factory made UPVC door frame made of UPVC extruded, Extruded section Profile size 42x50 mm.</td>
<td>Rmt.</td>
<td>30.00</td>
<td></td>
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<tr>
<td></td>
<td>Providing and fixing to existing door frames. 30mm thick factory made solid panel PVC door shutter consisting of frame made out of M.S. tubes of 19 gauge thickness and size of 19mm x 19mm for stiles, top &amp; bottom rails. M.S. frame shall have a coat of steel primers of approved make and manufacture M.S. frame covered with 5mm thick heat moulded PVC ‘C channel of size 30mm thickness, 110mm width out of which 90mm shall be flat and 20mm shall be tapered in 45 degree angle on either side forming stiles; and 5mm thick, 110mm wide PVC sheet out of which 90mm shall be flat and 20mm shall be tapered on the inner side to form top and bottom rail and 130mm wide PVC sheet out of which 90mm shall be flat and 20mm shall be tapered on both sides to form lock rail. Top bottom and lock rails shall be provided either side of the panel. 10mm (5mm x 2) thick, 20mm wide</td>
<td>Sqm.</td>
<td>10.08</td>
<td></td>
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<tr>
<td>No.</td>
<td>Description</td>
<td>Quantity</td>
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<tr>
<td>20</td>
<td>Providing and fixing white vitreous china flat back half stall urinal of size Range of two half stall urinals with 5 litre P.V.C. automatic flushing cistern.</td>
<td>No. 2.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>Providing and fixing White Vitreous China Wash Basin size 630x450 mm with a pair of 15 mm C.P. brass pillar taps.</td>
<td>No. 4.00</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>22</td>
<td>Providing and fixing PTMT Bottle Trap for Wash basin and sink. Bottle trap 38mm single piece moulded with height of 270mm, effective length of tail pipe 260mm from the centre of the waste coupling 77mm breadth with 25mm minimum water seal, weighing not less than 263gms.</td>
<td>No. 4.00</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>23</td>
<td>S/F C. I. Nahani (Floor) Trap</td>
<td>No. 10.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>Providing and fixing soil, waste and vent pipes: 75 mm dia.Centrifugally cast (spun) iron socketed pipe as per IS: 3989.</td>
<td>Rmt. 8.10</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No.</td>
<td>Description</td>
<td>Unit</td>
<td>Quantity</td>
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</tr>
<tr>
<td>25</td>
<td>Providing and fixing soil, waste and vent pipes: 100 mm dia. Centrifugally cast (spun) iron socketed pipe as per IS: 3989.</td>
<td>Rmt.</td>
<td>16.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>Providing and fixing plain bend of required degree. 100 mm Sand cast iron S&amp;S as per IS – 1729</td>
<td>No.</td>
<td>4.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>Providing lead caulked joints to sand cast iron/centrifugally cast (spun) iron 75 mm</td>
<td>No.</td>
<td>12.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>28</td>
<td>Providing lead caulked joints to sand cast iron/centrifugally cast (spun) iron 100 mm</td>
<td>No.</td>
<td>4.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>29</td>
<td>Providing and fixing white vitreous china pedestal type water closet (European type W.C.) pan with ISI marked white solid plastic seat and lid</td>
<td>No.</td>
<td>4.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>Providing and fixing square-mouth S.W. gully trap grade 'A' complete with C.I. grating brick masonry chamber with water tight C.I. cover with frame of 300 x300 mm size (inside) the weight of cover to be not less than 4.50 kg and frame to be not less than 2.70 kg as per standard design :100x100 mm size P type With F.P.S. Bricks class designation 75</td>
<td>No.</td>
<td>7.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>31</td>
<td>Providing and fixing mirror of superior glass (of approved quality) and of Rectangular shape 1500x450 mm</td>
<td>No.</td>
<td>2.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>32</td>
<td>Providing and fixing C.P. brass angle valve for basin mixer and geyser points of approved quality conforming to IS:8931 15 mm nominal bore</td>
<td>No.</td>
<td>4.00</td>
<td></td>
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<tr>
<td>No.</td>
<td>Description</td>
<td>Unit</td>
<td>Quantity</td>
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<tr>
<td>33</td>
<td>Providing and fixing toilet paper holder : C.P. brass</td>
<td></td>
<td>4.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>34</td>
<td>Providing and fixing PTMT towel rail complete with brackets fixed to wooden 600mm long towel rail with total length of 645mm, width 78mm and effective height of 88mm, weighing not less than 190gms.</td>
<td></td>
<td>2.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>35</td>
<td>Providing and fixing PTMT liquid soap container 109mm wide, 125mm high and 112mm distance from wall of standard shape with bracket of the same materials with snap fittings of approved quality and colours weighing not less than 105 gms</td>
<td></td>
<td>2.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>36</td>
<td>Providing and fixing C.P. brass bib cock of approved quality conforming to IS:8931 15 mm nominal bore</td>
<td></td>
<td>4.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>37</td>
<td>Providing and fixing P.V.C. low level flushing cistern with manually controlled device 10 litre capacity-White</td>
<td></td>
<td>4.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>38</td>
<td>Providing and laying Ceramic glazed floor tiles 300 x 300 mm (thickness to be specified by the manufacturer) of 1st quality conforming to IS :15622 of approved make in colours such as White, Ivory, Grey, Fume, Red Brown, laid on 20 mm thick Cement Mortar 1:4 (1 Cement : 4 Coarse sand) including pointing the joints with white cement and matching pigment etc., complete.</td>
<td>Sqm.</td>
<td>25.70</td>
<td></td>
<td></td>
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<tr>
<td>No.</td>
<td>Description</td>
<td>Unit</td>
<td>Quantity</td>
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<tr>
<td>39</td>
<td>Providing and fixing 1st quality ceramic glazed wall tiles conforming to IS : 15622 (thickness to be specified by the manufacture ) of approved make in all colours, shades except burgundy, bottle green, black of any size as approved by Engineer-in-Charge in skirting, risers of steps and dados over 12 mm thick bed of cement Mortar 1:3 (1 cement : 3 coarse sand) and jointing with grey cement slurry @ 3.3kg per sqm including pointing in white cement mixed with pigment of matching shade complete.</td>
<td>Sqm.</td>
<td>84.16</td>
<td></td>
<td></td>
</tr>
<tr>
<td>40</td>
<td>Cement plaster 1:3 (1 cement: 3 coarse sand) finished with a floating coat of neat cement. 20 mm cement plaster</td>
<td>Sqm.</td>
<td>18.88</td>
<td></td>
<td></td>
</tr>
<tr>
<td>41</td>
<td>Making soak pit 2.5 m diameter 3.0 metre deep with 45 x 45 cm dry brick honey With F.P.S. bricks</td>
<td>No.</td>
<td>1.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>42</td>
<td>Providing, laying and jointing glazed stoneware pipes grade 'A' with stiff mixture 100 mm diameter</td>
<td>Rmt.</td>
<td>15.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>43</td>
<td>Providing and laying cement concrete 1:5:10 (1 cement : 5 coarse sand : 10 graded 100 mm diameter S.W. pipe</td>
<td>Rmt.</td>
<td>15.00</td>
<td></td>
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</tr>
<tr>
<td>44</td>
<td>Providing and fixing G.I pipes complete with G.I. fittings including trenching and refilling etc.(external work) 40 mm dia nominal bore</td>
<td>Rmt.</td>
<td>200.00</td>
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<tr>
<td>No.</td>
<td>Description</td>
<td>Unit</td>
<td>Rate</td>
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<tr>
<td>45</td>
<td>Providing and fixing G.I pipes complete with G.I. fittings including trenching and refilling etc. (external work) 25 mm dia nominal bore</td>
<td>Rmt</td>
<td>13.00</td>
<td></td>
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</tr>
<tr>
<td>46</td>
<td>Providing and fixing G.I pipes complete with G.I. fittings and clamps, including cutting and making good the walls etc. internal work- Exposed on wall 15 mm dia nominal bore</td>
<td>Rmt</td>
<td>13.50</td>
<td></td>
<td></td>
</tr>
<tr>
<td>47</td>
<td>Providing &amp; Fixing BIO-DIGESTIBLE tank for Toilets</td>
<td>Nos</td>
<td>1.00</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. **Total Amount (in INR) – in figures**

2. **Total Amount (in INR) – in words**
## 10. RENOVATION OF EXISTING LODGING FACILITY

<table>
<thead>
<tr>
<th>S. N.</th>
<th>Item</th>
<th>Unit</th>
<th>Qty</th>
<th>Unit Rates (INR)</th>
<th>Amount (INR)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>In Figures</td>
<td>In Words</td>
</tr>
<tr>
<td>1</td>
<td>Stone work (machine cut edges) for wall lining etc. (veneer work)</td>
<td>Sqm.</td>
<td>54.28</td>
<td></td>
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<tr>
<td></td>
<td>backing filled with a grout of 12mm thick cement mortar 1:3 (1 cement : 3 coarse sand) including pointing in white cement mortar 1:2 (1 white cement : 2 stone dust) with an admixture of pigment matching the stone shade : (To be secured to the backing by means of cramps which shall be paid for separately) White sand stone - Exposed face machine cut and table rubbed with rough backing. 30 mm thick.</td>
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<tr>
<td>2</td>
<td>Providing and laying Ceramic glazed floor tiles 300x300 mm (thickness to be specified by the manufacturer) of 1st quality conforming to IS : 15622 of approved make in all colours, shades, except White, Ivory, Grey, Fume Red Brown laid on 20mm thick bed of Cement Mortar 1:4 (1 Cement : 4 Coarse sand) including pointing the joints with white cement and matching pigments etc., complete.</td>
<td>Sqm.</td>
<td>40.00</td>
<td></td>
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</tr>
<tr>
<td>3</td>
<td>Providing and laying vitrified floor tiles in different sizes (thickness to be specified by the manufacturer) with water absorption’s less than 0.08% and conforming to IS : 15622 of approved make in all colours and shades, laid on 20mm thick cement mortar 1:4 (1 cement: 4 coarse sand) including grouting the joints with white cement and matching pigments etc., complete. Size of Tile</td>
<td>Sqm.</td>
<td>14.26</td>
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<tr>
<td>60x60 cm</td>
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<tr>
<td>12 mm cement plaster of mix 1:6 (1 cement : 6 fine sand)</td>
<td></td>
<td>36.69</td>
<td></td>
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<tr>
<td>15 mm cement plaster on rough side of single or half brick wall of mix 1:6 (1 cement: 6 coarse sand)</td>
<td></td>
<td>48.87</td>
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<tr>
<td>20 mm cement plaster of mix 1:6 (1 cement: 6 coarse sand)</td>
<td></td>
<td>48.87</td>
<td></td>
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</tr>
<tr>
<td>Dismantling tile work in floors and roofs laid in cement mortar including stacking material within 50 metre lead. For thickness of tiles above 25 mm and upto 40 mm</td>
<td></td>
<td>14.26</td>
<td></td>
<td></td>
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<tr>
<td>Dismantling old plaster or skirting raking out joints and cleaning the surface for plaster including disposal of rubbish to the dumping ground within 50 metres lead.</td>
<td></td>
<td>174.43</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Providing and fixing M.S. flat iron tree guard 60cm dia. and 2m height above ground level formed of 4 nos. 25x6mm and 8 nos. 25x3mm vertical M.S. flats rivetted to 3 nos. 25x6mm M.S. flat iron rings in two halves, bolted together with 8mm dia. and 30mm long bolts including painting two coats with paint of approved brand and manufacture over a coat of priming, complete in all respects.</td>
<td></td>
<td>15.00</td>
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<td></td>
<td>Total Amount (in INR) – in figures</td>
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<td>2.</td>
<td>Total Amount (in INR) – in words</td>
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## 11. FURNITURE FOR EXISTING LODGING FACILITY

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<tr>
<th>S. N.</th>
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<td>In Figures</td>
<td>In Words</td>
</tr>
<tr>
<td>1</td>
<td>Mattress 1500x1800</td>
<td>Each</td>
<td>40</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Pillow</td>
<td>Each</td>
<td>40</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Pillow Cover + Bed sheets (for double bed)</td>
<td>Each</td>
<td>40</td>
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</tr>
<tr>
<td>4</td>
<td>Mink Blankets (double)</td>
<td>Each</td>
<td>40</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Quilt (single)</td>
<td>Each</td>
<td>40</td>
<td></td>
<td></td>
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<td></td>
<td>Description</td>
<td>Each</td>
<td></td>
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</tr>
<tr>
<td>6</td>
<td>Office Table 750x1500</td>
<td>2</td>
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</tr>
<tr>
<td>7</td>
<td>Badsheet Singal Mattress</td>
<td>40</td>
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<tr>
<td>8</td>
<td>Matt 3m x 3m</td>
<td>10</td>
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<tr>
<td>9</td>
<td>Almirah (1200 x 2100)</td>
<td>10</td>
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1. Total Amount (in INR) – in figures

2. Total Amount (in INR) – in words
### 12. CAMPING SITE

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<td>Amount (INR)</td>
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<td></td>
<td></td>
<td></td>
<td>In Figures</td>
<td>In Words</td>
</tr>
<tr>
<td>1</td>
<td>Earth work in excavation by mechanical means (Hydraulic Excavator) / manual means in foundation trenches or drains (not exceeding 1.5 m in width or 10 sqm on plan) including dressing of sides and ramming of bottoms, lift upto 1.5 m, including getting out the excavated soil and disposal of surplus excavated soil as directed, within a lead of 50 m. All kinds of soil.</td>
<td>Cum</td>
<td>143.03</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Filling available excavated earth (excluding rock) in trenches, plinth, sides of foundations etc. in layers not exceeding 20cm in depth, consolidating each deposited layer by ramming and watering, lead up to 50 m and lift upto 1.5 m.</td>
<td>Cum</td>
<td>122.63</td>
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<tr>
<td>3</td>
<td>Providing and laying in position cement concrete of specified grade excluding the cost of centering and shuttering - All work up to plinth level : 1:2:4 (1 cement : 2 coarse sand : 4 graded stone aggregate 20 mm nominal size)</td>
<td>Cum</td>
<td>21.78</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Providing and laying in position cement concrete of specified grade excluding the cost of centering and shuttering - All work up to plinth level : 1:3:6 (1 cement : 3 coarse sand : 6 graded stone aggregate 20 mm nominal size)</td>
<td>Sqm</td>
<td>3.60</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Description</td>
<td>Unit</td>
<td>Quantity</td>
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<tr>
<td>5</td>
<td>Centering shuttering including strutting, propping etc. and removal of form work for 2 Retaining walls, return walls, walls (any thickness) including attached pilasters, buttresses, plinth and string courses fillets etc.</td>
<td>Sqm.</td>
<td>115.42</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Providing and laying in position specified grade of reinforced cement concrete excluding the cost of centring, shuttering, finishing and reinforcement - All work upto plinth level 1:1.5:3 (1 cement : 1.5 coarse sand : 3 graded stone aggregate 20 mm nominal size)</td>
<td>Cum.</td>
<td>4.28</td>
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</tr>
<tr>
<td>7</td>
<td>Centring and shuttering including strutting, ropping etc. and removal of form for Stairs, (excluding landings) except spiral-staircases.</td>
<td>Sqm.</td>
<td>32.78</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Reinforcement for R.C.C. work including straightening, cutting, bending, placing in position and binding all complete.</td>
<td>Kg.</td>
<td>402.24</td>
<td></td>
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<tr>
<td>9</td>
<td>Random rubble masonry with hard stone in foundation and plinth including levellingup with cement concrete 1:6:12 (1 cement: 6 coarse sand : 12 graded stone aggregate 20mm nominal size) at plinth level with Cement mortar 1:6 (1 cement : 6 coarse sand)</td>
<td>Cum.</td>
<td>8.82</td>
<td></td>
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<tr>
<td>10</td>
<td>Extra for random rubble masonry with hard stone in superstructure above plinth level and upto floor five level, including leveling up with cement concrete 1:6:12 (1 cement :6 coarse sand : 12 graded stone aggregate 20mm nominal size) at window sills,</td>
<td>Cum.</td>
<td>2.03</td>
<td></td>
</tr>
<tr>
<td>No.</td>
<td>Description</td>
<td>Unit</td>
<td>Quantity</td>
<td></td>
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<tr>
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</tr>
<tr>
<td>11</td>
<td>Structural steel work in single section fixed with or without connecting plate including cutting, hoisting, fixing in position and applying a priming coat of approved steel primer all complete.</td>
<td>Kg.</td>
<td>800.50</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Pointing on stone work with cement mortar 1:3 (1 cement :3 fine sand) Raised and cut pointing</td>
<td>Cum.</td>
<td>40.00</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Providing and fixing M.S. flat iron tree guard 60cm dia. and 2m height above ground level formed of 4 nos. 25x6mm and 8 nos. 25x3mm vertical M.S. flats rivetted to 3 nos. 25x6mm M.S. flat iron rings in two halves, bolted together with 8mm dia. and 30mm long bolts including painting two coats with paint of approved brand and manufacture over a coat of priming, complete in all respects.</td>
<td>No.</td>
<td>16</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Providing and supplying Dust Bin (ready made) of approved shape size and material</td>
<td>No.</td>
<td>50.00</td>
<td></td>
</tr>
</tbody>
</table>

1. **Total Amount (in INR) – in figures**

2. **Total Amount (in INR) – in words**
### 13. RENOVATION WORK OF TEMPLE AND VYAS GUFA

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Item</th>
<th>Unit</th>
<th>Qty</th>
<th>Unit Rates (INR)</th>
<th>Amount (INR)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>1. Stone work (machine cut edges) for wall lining etc. (veneer work) backing filled with a grout of 12mm thick cement mortar 1:3 (1 cement : 3 coarse sand) including pointing in white cement mortar 1:2 (1 white cement : 2 stone dust) with an admixture of pigment matching the stone shade: (To be secured to the backing by means of cramps which shall be paid for separately) White sand stone - Exposed face machine cut and table rubbed with rough backing. 30 mm thick.</strong></td>
<td>Sqm.</td>
<td>89.33</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>2. Providing wood work in frames of doors, windows, clerestory windows and other frames, wrought framed and fixed in position Second class teak wood</strong></td>
<td>Cum.</td>
<td>0.12</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>3. Providing and fixing panelled or panelled and glazed shutters for doors, windows and clerestory windows including ISI marked black enamelled M.S butt hinges with necessary screws excluding panelling which will be paid for separately. Second class teak wood 35 mm thick shutters</strong></td>
<td>Sqm.</td>
<td>2.63</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>4. Providing and fixing 2nd class teak wood plain lining tongued and grooved on and including wooden plugs complete with necessary screws and priming coat on unexposed surface 40 mm thick</strong></td>
<td>Sqm.</td>
<td>201.58</td>
<td></td>
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</tr>
<tr>
<td></td>
<td>Description</td>
<td>Area</td>
<td>Rate</td>
<td></td>
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<tr>
<td>5</td>
<td>Chequered precast cement concrete tiles 22 mm thick in footpath &amp; courtyard jointed with neat cement slurry mixed with pigment to match the shade of tiles including rubbing and cleaning etc. complete on 20 mm thick bed of cement mortar 1:4 (1 cement: 4 coarse sand). Dark shade using ordinary cement.</td>
<td>Sqm.</td>
<td>110.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Chequered precast cement concrete tiles 22 mm thick in footpath &amp; courtyard jointed with neat cement slurry mixed with pigment to match the shade of tiles including rubbing and cleaning etc. complete on 20 mm thick bed of cement mortar 1:4 (1 cement: 4 coarse sand). Ordinary cement without any pigment.</td>
<td>Sqm.</td>
<td>48.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>25mm wooden planking, tongued and grooved in flooring including fixing with iron screws complete with Second class deodar wood</td>
<td>Sqm.</td>
<td>40.97</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>20 mm cement plaster of mix 1:6 (1 cement : 6 find sand)</td>
<td>Sqm.</td>
<td>117.72</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Colour washing such as green, blue or buff to give an even shade New work (two or more coats) with a base coat of white washing with lime</td>
<td>Sqm.</td>
<td>117.72</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Dismantling tile work in floors and roofs laid in cement mortar including stacking material within 50 metre lead. For thickness of tiles above 25 mm and upto 40 mm</td>
<td>Sqm.</td>
<td>26.55</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Dismantling old plaster or skirting raking out joints and cleaning the surface for plaster including disposal of rubbish to the dumping ground within 50</td>
<td>Sqm.</td>
<td>117.72</td>
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<tr>
<td></td>
<td>metres lead.</td>
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<tr>
<td>1.</td>
<td>Total Amount (in INR) – in figures</td>
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</tr>
<tr>
<td>2.</td>
<td>Total Amount (in INR) – in words</td>
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### 14. DIRECTIONAL SIGNAGE

<table>
<thead>
<tr>
<th>S. N.</th>
<th>Item</th>
<th>Unit</th>
<th>Qty</th>
<th>Unit Rates (INR)</th>
<th>Amount (INR)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>In Figures</td>
<td>In Words</td>
</tr>
<tr>
<td>1</td>
<td>Excavation work by mechanical means (Hydraulic Excavator)/ manual means in foundation trenches or drains not exceeding 1.5 m in width or 10 sqm on plan including dressing of sides and ramming of bottoms lift upto 1.5 m, including getting out the excavated soil and disposal of surplus excavated soils as directed, within a lead of 50m. Ordinary rock</td>
<td>Cum.</td>
<td>1.44</td>
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</tr>
<tr>
<td>2</td>
<td>Providing and laying in position cement concrete of specified grade excluding the cost of centering and shuttering - All work up to plinth level : 1:3:6 (1 Cement : 3 coarse sand : 6 graded stone aggregate 20 mm nominal size)</td>
<td>Cum.</td>
<td>0.36</td>
<td></td>
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</tr>
<tr>
<td>3</td>
<td>Random rubble masonry with hard stone in foundation and plinth including levellingup with cement concrete 1:6:12 (1 cement : 6 coarse sand : 12 graded stone aggregate 20mm nominal size) at plinth level with Cement mortar 1:6 (1 cement : 6 coarse sand)</td>
<td>Cum.</td>
<td>0.75</td>
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</tr>
<tr>
<td>4</td>
<td>Providing and laying in position cement concrete of specified grade excluding the cost of centering and shuttering - All work up to plinth level : 1:2:4 (1 cement : 2 coarse sand : 4 graded stone aggregate 20 mm nominal size)</td>
<td>Cum.</td>
<td>0.50</td>
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</tr>
<tr>
<td>5</td>
<td>Stone work in plain ashlar in super structure upto floor five level in cement mortar 1:6 (1 cement : 6 coarse sand) including pointing with cement mortar</td>
<td>Cum.</td>
<td>1.13</td>
<td></td>
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<tr>
<td></td>
<td>Description</td>
<td>Units</td>
<td>Quantity</td>
<td></td>
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<tr>
<td>6</td>
<td>1:2 (1 white cement: 2 stone dust) with an admixture of pigment matching the stone shade One face dressed. White sand stone</td>
<td></td>
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</tr>
<tr>
<td>7</td>
<td>Extra for plain ashlar or ashlar punched in Square or rectangular pillars</td>
<td>Cum.</td>
<td>1.13</td>
<td></td>
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</tr>
<tr>
<td>7</td>
<td>Providing and fixing aluminium work for doors, windows, ventilators and partitions For fixed portion. Anodised aluminium (anodised transparent or dyed to required shade according to IS: 1868, Minimum anodic coating of grade AC 15)</td>
<td>Kg.</td>
<td>16.00</td>
<td></td>
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<tr>
<td>8</td>
<td>Providing and fixing Anodised aluminium sheet 2.5 mm thick including writing/engraving necessary information as directed by Engineer-in-charge.</td>
<td>Kg.</td>
<td>14.18</td>
<td></td>
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</tbody>
</table>

3. Total Amount (in INR) – in figures

4. Total Amount (in INR) – in words
## 15. INFORMATIVE DISPLAY & PUBLICITY WORK

<table>
<thead>
<tr>
<th>S. N.</th>
<th>Item</th>
<th>Unit</th>
<th>Qty</th>
<th>Unit Rates (INR)</th>
<th>Amount (INR)</th>
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<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Excavation work by mechanical means (Hydraulic Excavator)/ manual means in foundation trenches or drains not exceeding 1.5 m in width or 10 sqm on plan including dressing of sides and ramming of bottoms lift upto 1.5 m, including getting out the excavated soil and disposal of surplus excavated soils as directed, within a lead of 50m. Ordinary rock</td>
<td>Cum.</td>
<td>46.31</td>
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</tr>
<tr>
<td>2</td>
<td>Providing and laying in position cement concrete of specified grade excluding the cost of centering and shuttering - All work up to plinth level :1:3:6 (1 Cement : 3 coarse sand : 6 graded stone aggregate 20 mm nominal size)</td>
<td>Cum.</td>
<td>6.62</td>
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</tr>
<tr>
<td>3</td>
<td>Random rubble masonry with hard stone in foundation and plinth including levelling up with cement concrete 1:6:12 (1 cement: 6 coarse sand : 12 graded stone aggregate 20 mm nominal size) at plinth level with Cement mortar 1:6 (1 cement : 6 coarse sand)</td>
<td>Cum.</td>
<td>39.69</td>
<td></td>
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</tr>
<tr>
<td>4</td>
<td>Stone work in plain ashlar in super structure upto floor five level in cement mortar 1:6 (1 cement : 6 coarse sand) including pointing with cement mortar 1:2 (1 white cement : 2 stone dust) with an admixture of pigment matching the stone shade Ashlar Masonary One face dressed, White sand stone</td>
<td>Cum.</td>
<td>45.23</td>
<td></td>
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</tr>
<tr>
<td>5</td>
<td>Kota stone slab flooring over 20 mm (average) thick base laid over and jointed with grey cement slurry mixed with pigment to match the shade of the</td>
<td>Cum.</td>
<td>44.10</td>
<td></td>
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</tr>
<tr>
<td></td>
<td>Description</td>
<td>Unit</td>
<td>Quantity</td>
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<td>-----------------------------------------------------------------------------</td>
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</tr>
<tr>
<td>6</td>
<td>Providing wood work in frames of doors, windows, clerestory windows and other frames, wrought framed and fixed in position Second class teak wood</td>
<td>Cum.</td>
<td>7.82</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Providing and fixing 2nd class teak wood plain lining tongued and grooved on and including wooden plugs complete with necessary screws and priming coat on unexposed surface 40 mm thick</td>
<td>Sqm.</td>
<td>129.60</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Providing and laying certain teed roofing shingles (Moire Black colour) on the sloping roof with help of tar plastic adhesive and roofing nail fixed at 8 inches distance, including a coat of bituminous primer, fixing of starter strip as first course and finally fixing hips and ridges as per manufactures specifications complete in all respect.</td>
<td>Sqm.</td>
<td>360.00</td>
<td></td>
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</tr>
<tr>
<td>9</td>
<td>Providing and fixing 18mm thick gang saw cut mirror polished (premoulded and prepolished) machine cut for kitchen platforms, vanity counters, window sills, facias and similar locations of required size of approved shade, colour and texture laid over 20mm thick base cement mortar 1:4 (1 cement : 4 coarse sand) with joints treated with white cement, mixed with matching pigment, epoxy touch ups, including rubbing, curing moulding and polishing to edge to give high gloss finish etc. complete at all levels Granite of any colour and shade Area of slab over 0.50 sqm</td>
<td>Sqm.</td>
<td>43.20</td>
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<tr>
<td>10</td>
<td>Engraving letters in hard stone as per directed by Engineer-in-charge.</td>
<td>Cm</td>
<td>90000.00</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### 1. Total Amount (in INR) – in figures

### 2. Total Amount (in INR) – in words

#### 16. PATHWAY COVERING SHALTER

<table>
<thead>
<tr>
<th>S. N.</th>
<th>Item</th>
<th>Unit</th>
<th>Qty</th>
<th>Unit Rates (INR)</th>
</tr>
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<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>In Figures</td>
</tr>
<tr>
<td>1</td>
<td>Excavation work by mechanical means (Hydraulic Excavator)/ manual means in foundation trenches or drains not exceeding 1.5 m in width or 10 sqm on plan including dressing of sides and ramming of bottoms lift upto 1.5 m, including getting out the excavated soil and disposal of surplus excavated soils as directed, within a lead of 50m. Ordinary rock</td>
<td>Cum.</td>
<td>31.70</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Filling available excavated earth (excluding rock) in trenches, plinth, sides of foundations etc. in layers not exceeding 20cm in depth, consolidating each deposited layer by ramming and watering, lead up to 50 m and lift upto 1.5 m.</td>
<td>Cum.</td>
<td>25.85</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Providing and laying in position cement concrete of specified grade excluding the cost of centring and shuttering - -All work upto plinth level 1:5:10 (1 cement : 5 coarse sand : 10 graded stone aggregate 40 mm nominal size)</td>
<td>Sqm.</td>
<td>5.85</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Description</td>
<td>Unit</td>
<td>Amount</td>
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</tr>
<tr>
<td>4</td>
<td>Providing and laying in position specified grade of reinforced cement concrete excluding the cost of centring, shuttering, finishing and reinforcement - All work upto plinth level 1:1.5:3 (1 cement : 1.5 coarse sand : 3 graded stone aggregate 20 mm nominal size)</td>
<td>Cum.</td>
<td>11.05</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Centring and shuttering including strutting, ropping etc. and removal of form for foundations, footings, bases of columns, etc. for mass concrete.</td>
<td>Sqm.</td>
<td>61.50</td>
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</tr>
<tr>
<td>6</td>
<td>Centring and shuttering including strutting, ropping etc. and removal of form for Lintels, beams, plinth beams, girders, bressumers and cantilevers.</td>
<td>Sqm.</td>
<td>36.00</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Reinforcement for R.C.C. work including straightening, cutting, bending, placing in position and binding all complete. Reinforcement for R.C.C. Work Using Thermo-Mechanically Treated Bars</td>
<td>Kg.</td>
<td>1633.10</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Structural steel work in single section fixed with or without connecting plate including cutting, hoisting, fixing in position and applying a priming coat of approved steel primer all complete.</td>
<td>Kg.</td>
<td>9378.75</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Providing corrugated G.S. sheet roofing including vertical/ curved surface fixed 0.80mm thick with zinc coating not less than 275gm/m</td>
<td>Sqm.</td>
<td>160.00</td>
<td></td>
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</tbody>
</table>

1. Total Amount (in INR) – in figures
| 2. Total Amount (in INR) – in words |
### 17. REST SHALTER

<table>
<thead>
<tr>
<th>S. N.</th>
<th>Item</th>
<th>Unit</th>
<th>Qty</th>
<th>Unit Rates (INR)</th>
<th>Amount (INR)</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Earth work in excavation by mechanical means (Hydraulic Excavator)/ manual means in foundation trenches or drains (not exceeding 1.5 m in width or 10 sqm on plan) including dressing of sides and ramming of bottoms, lift upto 1.5 m, including getting out the excavated soil and disposal of surplus excavated soil as directed, within a lead of 50 m. All kinds of soil.</td>
<td>Cum.</td>
<td>23.09</td>
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<tr>
<td></td>
<td>Providing and laying in position cement concrete of specified grade excluding the cost of centring and shuttering - -All work upto plinth level 1:3:6 (1 Cement : 3 coarse sand : 6 graded stone aggregate 20 mm nominal size).</td>
<td>Cum.</td>
<td>3.85</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Reinforcement for R.C.C. work including straightening, cutting, bending, placing in position and binding all complete. Reinforcement for R.C.C. Work Using Cold Twisted Bars</td>
<td>Kg.</td>
<td>2328.28</td>
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<td>Providing and laying in position specified grade of reinforced cement concrete excluding the cost of centring, shuttering, finishing and reinforcement - All work upto plinth level 1:1.5:3 (1 cement : 1.5 coarse sand : 3 graded stone aggregate 20 mm nominal size)</td>
<td>Cum.</td>
<td>19.17</td>
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<td></td>
<td>Centring and shuttering for foundations, footings, bases of columns, etc. for mass concrete.</td>
<td>Sqm</td>
<td>76.62</td>
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<td></td>
<td>Description</td>
<td>Unit</td>
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<tr>
<td>6</td>
<td>Reinforced cement concrete work in walls (any thickness), including attached pilasters, buttresses, plinth and string courses, fillets, columns, pillars, piers, abutments, posts and struts etc. upto floor five level excluding cost of centring, shuttering, finishing and reinforcement 1:1.5:3 (1 cement : 1.5 coarse sand : 3 graded stone aggregate 20 mm nominal size)</td>
<td>Cum.</td>
<td>3.88</td>
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</tr>
<tr>
<td>7</td>
<td>Centring and shuttering including strutting, roping etc. and removal of form for Columns, Pillars, Piers, Abutments, Posts and Struts.</td>
<td>Sqm.</td>
<td>88.08</td>
<td></td>
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</tr>
<tr>
<td>8</td>
<td>Coursed rubble masonry (first sort) with hard stone in foundation and plinth with Cement mortar 1:6 (1 cement: 6 coarse sand)</td>
<td>Cum.</td>
<td>5.27</td>
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<tr>
<td>9</td>
<td>Providing and laying cement concrete in retaining walls, return walls (any thickness) including attached pilasters, columns, pillars, posts, struts, buttresses, string or lacing courses, parapets, coping bed blocks, anchor blocks, plain window sills, fillets etc. upto floor five level, excluding the cost of centring, shuttering and finishing 1:2:4 (1 Cement : 2 coarse sand : 4 graded stone aggregate 20 mm nominal size).</td>
<td>Cum.</td>
<td>8.33</td>
<td></td>
<td></td>
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<tr>
<td>10</td>
<td>Centering shuttering including struttings, propping etc. and removal of form work for 2 Retaining walls, return walls, walls (any thickness) including attached pilasters, buttresses, plinth and string courses fillets etc.</td>
<td>Sqm.</td>
<td>4.29</td>
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<tr>
<td>11</td>
<td>Reinforced cement concrete work in beams, suspended floors, roofs having slope up to 15 degree landings, balconies, shelves, chajjas, lintels,</td>
<td>Cum.</td>
<td>10.13</td>
<td></td>
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</tr>
<tr>
<td></td>
<td>Description</td>
<td>Unit</td>
<td>Quantity</td>
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<tr>
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<td></td>
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</tr>
<tr>
<td>12</td>
<td>Centring and Shuttering for Suspended floors, roofs, landings, balconies and access platform.</td>
<td>Sqm</td>
<td>93.56</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Kota stone slab flooring over 20 mm (average) thick base laid over and jointed with grey cement slurry mixed with pigment to match the shade of the slab including rubbing and polishing complete with base of cement mortar 1 : 4 (1 cement : 4 coarse sand) : 25 mm thick.</td>
<td>Sqm</td>
<td>30.26</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Supplying and stacking at site. Good earth.</td>
<td>Cum</td>
<td>9.06</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Filling available excavated earth (excluding rock) in trenches, plinth, sides of foundations etc. in layers not exceeding 20cm in depth, consolidating each deposited layer by ramming and watering, lead up to 50 m and lift upto 1.5 m.</td>
<td>Cum</td>
<td>9.06</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>Providing and laying in position cement concrete of specified grade excluding the cost of centering and shuttering - All work up to plinth level : 1:2:4 (1 cement : 2 coarse sand : 4 graded stone aggregate 20 mm nominal size)</td>
<td>Cum</td>
<td>2.35</td>
<td></td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>12 mm cement plaster of mix 1:6 (1 cement : 6 coarse sand)</td>
<td>Sqm</td>
<td>209.67</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>Description</td>
<td>Unit</td>
<td>Quantity</td>
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</tr>
<tr>
<td>18</td>
<td>Extra for plastering done on moulding cornices or architraves including neat finish in two coats</td>
<td>Sqm</td>
<td>76.35</td>
<td></td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>Pointing on stone work with cement mortar 1:3 (1 cement :3 fine sand) Raised and cut pointing</td>
<td>Sqm.</td>
<td>10.13</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>Making plinth protection 50mm thick of cement concrete 1:3:6 (1 cement :3 coarse sand :6 graded stone aggregate 20mm nominal size) over 75mm bed by dry brick ballast 40mm nominal size well rammed and consolidated and grouted with fine sand including finishing the top smooth</td>
<td>Sqm</td>
<td>10.80</td>
<td></td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>Demolishing R.C.C. work manually/ by mechanical means including stacking of steel bars and disposal of unserviceable material within 50 metres lead as per direction of Engineer - in- charge.</td>
<td>Cum.</td>
<td>28.80</td>
<td></td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>Extra for cutting reinforcement bars manually / by mechanical means in R.C.C. or R.B. work (Payment shall be made on the cross sectional area of R.C.C. or R.B. work) as per direction of Engineer - in-charge.</td>
<td>Sqm</td>
<td>48.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>Dismantling steel work in built up sections in angles, tees, flats and channels including all gusset plates, bolts, nuts, cutting rivets, welding etc. including dismembering and stacking within 50metres lead.</td>
<td>Kg</td>
<td>2377.80</td>
<td></td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>Extra for dismantling trusses, rafters, purlins etc. of steel work for every additional span of one metre or part thereof beyond 10 metre</td>
<td>Kg</td>
<td>5548.20</td>
<td></td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>Demolishing cement concrete manually/ by mechanical means including disposal of material within 50 metres lead as per direction of Engineer in charge. 1:3:6 or richer mix</td>
<td>Cum.</td>
<td>28.80</td>
<td></td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>Demolishing stone rubble masonry manually/by mechanical means including stacking of serviceable material and disposal of unserviceable material within 50 metres lead as per direction of Engineer-in-charge In cement mortar</td>
<td>Cum.</td>
<td>36.00</td>
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1. **Total Amount (in INR) – in figures**

2. **Total Amount (in INR) – in words**
## 18. RETAINING WALL AND BREAST WALL

<table>
<thead>
<tr>
<th>S. N.</th>
<th>Item</th>
<th>Unit</th>
<th>Qty</th>
<th>Unit Rates (INR)</th>
<th>Amount (INR)</th>
</tr>
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<tbody>
<tr>
<td></td>
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<td></td>
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</tr>
<tr>
<td>1</td>
<td>Excavation work by mechanical means (Hydraulic Excavator)/ manual means in foundation trenches or drains not exceeding 1.5 m in width or 10 sqm on plan including dressing of sides and ramming of bottoms lift upto 1.5 m, including getting out the excavated soil and disposal of surplus excavated soils as directed, within a lead of 50m. Ordinary rock</td>
<td>Cum.</td>
<td>419.93</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Providing and laying in position cement concrete of specified grade excluding the cost of centring and shuttering - All work upto plinth level 1:5:10 (1 cement : 5 coarse sand : 10 graded stone aggregate 40 mm nominal size)</td>
<td>Cum.</td>
<td>92.76</td>
<td></td>
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</tr>
<tr>
<td>3</td>
<td>Providing and laying cement concrete in retaining walls, return walls (any thickness) including attached pilasters, columns, piers, abutments, pillars, posts, struts, buttresses, string or lacing courses, parapets, coping bed blocks, anchor blocks, plain window sills, fillets etc upto floor five level, excluding the cost of centring, shuttering and finishing 1:2:4 (1 Cement : 2 coarse sand : 4 graded stone aggregate 20 mm nominal size).</td>
<td>Cum.</td>
<td>14.40</td>
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</tr>
<tr>
<td>4</td>
<td>Pointing on stone work with cement mortar 1:3 (1 cement :3 fine sand) Raised and cut pointing</td>
<td>Sqm</td>
<td>580.00</td>
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<td></td>
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<tr>
<td></td>
<td>Description</td>
<td>Cum.</td>
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<tr>
<td>5</td>
<td>Random rubble masonry with hard stone in foundation and plinth including levelling up with cement concrete 1:6:12 (1 cement : 6 coarse sand : 12 graded stone aggregate 20mm nominal size) at plinth level with Cement mortar 1:6 (1 cement : 6 coarse sand)</td>
<td>253.05</td>
<td></td>
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<tr>
<td>6</td>
<td>Extra for random rubble masonry with hard stone in superstructure above plinth level and upto floor five level, including leveling up with cement concrete 1:6:12 (1 cement : 6 coarse sand : 12 graded stone aggregate 20mm nominal size) with Cement mortar 1:6 (1 cement : 6 coarse sand)</td>
<td>507.50</td>
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<tr>
<td>7</td>
<td>Retaining Walls / Breast Walls Construction of retaining walls/breast walls in cement mortar 1:5 as per drawing and technical specifications Clause 1604 Filter material behind retaining wall / breast wall as per Specification 1204.3.8.</td>
<td>108.00</td>
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</table>

1. **Total Amount (in INR) – in figures**

2. **Total Amount (in INR) – in words**
### 19. OPTIONALS ITEMS

<table>
<thead>
<tr>
<th>S. N.</th>
<th>Item</th>
<th>Unit</th>
<th>Qty</th>
<th>Amount (INR)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Demolishing lime concrete manually/ by mechanical means and disposal of material within 50 metres lead as per direction of Engineer in charge.</td>
<td>Cum.</td>
<td>7.20</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Demolishing cement concrete manually/ by mechanical means including disposal of material within 50 metres lead as per direction of Engineer in charge. 1:3:6 or richer mix</td>
<td>Cum.</td>
<td>28.11</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Demolishing R.C.C. work manually/ by mechanical means including stacking of steel bars and disposal of unserviceable material within 50 metres lead as per direction of Engineer - in- charge.</td>
<td>Cum.</td>
<td>3.26</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Demolishing R.B. work manually/ by mechanical means including stacking of steel bars and disposal of unserviceable material within 50 metres lead as per direction of Engineer-in- charge.</td>
<td>Cum.</td>
<td>1.69</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Extra for cutting reinforcement bars manually / by mechanical means in R.C.C. or R.B. work (Payment shall be made on the cross sectional</td>
<td>Sqm.</td>
<td>31.00</td>
<td></td>
</tr>
<tr>
<td>No.</td>
<td>Description</td>
<td>Unit</td>
<td>Quantity</td>
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<tr>
<td>6</td>
<td>Extra for scrapping, cleaning and straightening reinforcement from R.C.C. or R.B. work</td>
<td>Kg.</td>
<td>8.00</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Demolishing brick work, manually/ by mechanical means including stacking of serviceable material and disposal of unserviceable material within 50 metres lead as per direction of Engineer-in-charge. In cement mortar</td>
<td>Cum.</td>
<td>12.40</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Removing mortar from bricks and cleaning bricks including stacking within a lead of 50 m (stacks of cleaned bricks shall be measured) From brick work in cement mortar</td>
<td>No.</td>
<td>1000.00</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Demolishing stone rubble masonry manually/ by mechanical means including stacking of serviceable material and disposal of unserviceable material within 50 metres lead as per direction of Engineer-in-charge In cement mortar</td>
<td>Cum.</td>
<td>18.25</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Dismantling dressed stone work ashlar face stone work, marble work or precast concrete work manually/ by mechanical means including stacking of serviceable and disposal of unserviceable material within 50 metres lead as per direction of Engineer-in-charge In cement mortar</td>
<td>Cum.</td>
<td>3.70</td>
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<tr>
<td>11</td>
<td>Removing mortar from and cleaning stones and concrete articles (net quantity of stacks of cleaned material will be measured): In cement mortar</td>
<td>Cum.</td>
<td>2.79</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Dismantling doors, windows and clerestory windows (steel or wood) shutter including chowkhats, architrave, holdfasts etc. complete and stacking within 50 metres lead Of area 3 sq. metres and below</td>
<td>No.</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Dismantling doors, windows and clerestory windows (steel or wood) shutter including chowkhats, architrave, holdfasts etc. complete and stacking within 50 metres lead Of area beyond 3 sq. metres</td>
<td>No.</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Taking out doors, windows and clerestory window shutters (steel or wood) including stacking within 50 metres lead Of area 3 sq. metres and below</td>
<td>No.</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Taking out doors, windows and clerestory window shutters (steel or wood) including stacking within 50 metres lead Of area beyond 3 sq. metres</td>
<td>No.</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>Dismantling wood work in frames, trusses, purlins and rafters up to 10 metres span and 5 metres height including stacking the material within 50 metres lead</td>
<td>Cum.</td>
<td>14.70</td>
<td></td>
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<tr>
<td></td>
<td>Description</td>
<td>Rate</td>
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<tr>
<td>17</td>
<td>Dismantling wood work in frames, trusses, purlins and rafters up to 10 metres span and 5 metres height including stacking the material within 50 metres lead of sectional area below 40 square centimetres.</td>
<td>Rmt. 12.00</td>
<td></td>
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</tr>
<tr>
<td>18</td>
<td>Extra for dismantling trusses, rafters, purlins etc. of wood work for every additional span of one metre or part thereof beyond 10 metres of sectional area below 40 square centimetres and above.</td>
<td>Cum. 4.14</td>
<td></td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>Extra for dismantling trusses, rafters, purlins etc. of wood work for every additional span of one metre or part thereof beyond 10 metres of sectional area below 40 square centimetres.</td>
<td>Rmt. 10.00</td>
<td></td>
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</tr>
<tr>
<td>20</td>
<td>Dismantling precast concrete or stone slab in walls, partition walls etc., including stacking within 50 metres lead. Thickness up to 40 mm</td>
<td>Sqm. 6.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>Dismantling precast concrete or stone slab in walls, partition walls etc., including stacking within 50 metres lead. Thickness above 40 mm up to 75 mm</td>
<td>Sqm. 3.20</td>
<td></td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>Dismantling manually / by mechanical means including stacking of serviceable material and disposal of unserviceable material within 50 metres</td>
<td>Sqm. 36.50</td>
<td></td>
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</tr>
<tr>
<td>S. No.</td>
<td>Description</td>
<td>Unit</td>
<td>Rate</td>
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<tr>
<td>23</td>
<td>Dismantling manually / by mechanical means including stacking of serviceable material and disposal of unserviceable material within 50 metres lead as per direction of Engineer-in-charge Water bound macadam road</td>
<td>Sqm.</td>
<td>20.00</td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>Dismantling G.I. pipes (external work) including excavation and refilling trenches after taking out the pipes manually / by mechanical means including stacking of pipes within 50 metres lead as per direction of Engineer-in-charge 15 mm to 40 mm nominal bore</td>
<td>Rmt.</td>
<td>30.00</td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>Dismantling G.I. pipes (external work) including excavation and refilling trenches after taking out the pipes manually / by mechanical means including stacking of pipes within 50 metres lead as per direction of Engineer-in-charge Above 40 mm nominal bore</td>
<td>Rmt.</td>
<td>20.00</td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>Dismantling old plaster or skirting raking out joints and cleaning the surface for plaster including disposal of rubbish to the dumping ground within 50 metres lead.</td>
<td>Sqm.</td>
<td>200.00</td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>Demolishing C.C. /R.C.C. work by mechanical means and stockpiling at designated locations and disposal of dismantled materials up to a lead of</td>
<td>Cum.</td>
<td>1.50</td>
<td></td>
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</tbody>
</table>
1000m, stacking serviceable and unserviceable material separately including cutting reinforcement bars.

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<tr>
<td><strong>1. Total Amount (in INR) – in figures</strong></td>
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<tr>
<td><strong>2. Total Amount (in INR) – in words</strong></td>
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## 20. SOLAR LIGHTING & SOLAR POWER PLANT

<table>
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<tr>
<th>S. N.</th>
<th>Item</th>
<th>Unit</th>
<th>Qty</th>
<th>Unit Rates (INR)</th>
<th>Amount (INR)</th>
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<tr>
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</tr>
<tr>
<td>1</td>
<td>Providing &amp; Fixing PHILIPS solar LED street light 15 W complete with all vis panel, battery, pole with three day autonomy as per enclosed specification.</td>
<td>Nos</td>
<td>25</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Supply Installation and Commissioning of 2 KWp Solar Photo-Voltaic Power Plant with 2.50 KVA Inverter, Battery Bank of capacity 96V DC, 400 AH, Tubular Type Lead Acid / VRLA /GEL type Battery including all fitting fixing, Mounting Structure of Galvanized M.S. Angle , Crystalline SPV modules of capacity ranging between 80 Wp to 250 Wp to be connected in appropriate series-parallel combinations to form a SPV array of a minimum 2 KWp Capacity, Battery Stand , copper cabling of suitable size &amp; rating, junction boxes with all other fitting &amp; fixing, Energy meter of reputed make for measurement of energy usage from the Plant and civil foundation work to complete the job as per specification at Part – II (e) of Annexure – I on turn-key basis for stable &amp; reliable operation including 5 years Warranty period from the date of commissioning of the plant(25 years Warranty for SPV Modules)</td>
<td>Nos</td>
<td>1</td>
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1. Total Amount (in INR) – in figures

2. Total Amount (in INR) – in words
## 21. FIRE FIGHTING WORK

<table>
<thead>
<tr>
<th>S. N.</th>
<th>Item</th>
<th>Unit</th>
<th>Qty</th>
<th>Unit Rates (INR)</th>
<th>Amount (INR)</th>
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<tr>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Providing &amp; Fixing Ceasefire Brand ABC MAP- IS 13849, ISO 9001 &amp; CE certified extinguishers and carry the certificates, the extinguishers manufactured as per IS 15683: 2006. Performance as per IS 15683: 2006, have Fire Rating of 21A, 183 B, extinguisher body made up of Mild steel and thickness of the body 2.0 mm, contain Mono Ammonium Phosphate (100% pure)to net weight) as Fire fighting agent. Mono Ammonium phosphate powder discharge less than 14 sec. Activation time of the Fire Extinguisher 2 seconds, Minimum powder discharge of extinguisher when valve is fully opened 95% Fire Extinguisher have Pressure Gauge that can be tested even in pressurized state, i.e. without discharging the extinguisher, Hose pipe (EPDM rubber) of 1 metre. 4 Kg Capacity</td>
<td>Nos</td>
<td>8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Providing &amp; Fixing Ceasefire Brand CO2 Squeeze Grip extinguishers equipped with used – unused indicator, Squeeze Grip, Applicable on class B &amp; C Fire Rating 13 B, ISI, ISO &amp; DOE certified Trolley Mounted For easy Movement 4.5 Kg Capacity</td>
<td>Nos</td>
<td>3</td>
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</table>

1. Total Amount (in INR) – in figures

2. Total Amount (in INR) – in words
### 22. ELECTRICAL WORK

<table>
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<tr>
<th>S. N.</th>
<th>Item</th>
<th>Unit</th>
<th>Qty</th>
<th>Unit Rates (INR)</th>
<th>Amount (INR)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MVCBGR25 MV cable laying upto 25 sq. mm. in ground. Laying of one number PVC insulated and PVC sheathed /XLPE power cable of 1.1KV grade of size not exceeding 25 sq. mm direct in ground including excavation, sand cushioning, protective covering and refilling the trench etc. as required.</td>
<td>Meter</td>
<td>2000.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>MVCBPIP25 MV cable laying upto 25 sq.mm. in pipe. Laying of one number PVC insulated and PVC sheathed /XLPE power cable of 1.1KV grade of size not exceeding 25 sq. mm in the existing RCC/HUME/STONEWARE/ METAL pipe as required.</td>
<td>Meter</td>
<td>50.00</td>
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<tr>
<td>2</td>
<td>MVCBOD25 MV cable laying upto 25 sq.mm. in open duct. Laying of one number PVC insulated and PVC sheathed /XLPE power cable of 1.1KV grade of size not exceeding 25 sq. mm in the existing masonry open duct as required.</td>
<td>Meter</td>
<td>3010.00</td>
<td></td>
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<tr>
<td>3</td>
<td>MVOJ S/M LV/MV outdoor cable jointing. Supplying and making outdoor end termination with cast resin compound including aluminium lugs and other jointing materials for following size of PVC insulated and PVC sheathed /XLPE aluminium conductor cable of 1.1 KV grade as required. 2 x 16</td>
<td>Nos</td>
<td>6</td>
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<tr>
<td>5</td>
<td>EARPIPCHAR G.I earth pipe electrode with Salt/charcoal: Earthing with G.I earth pipe 4.5 mtr long, 40 mm dia including accessories, and providing masonry enclosure with cover plate having locking arrangement and watering pipe etc. with charcoal and salt as required</td>
<td>Set</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>EARGIPL G.I earth plate electrode: Earthing with G.I earth plate 600 mm x 600 mm x 6 mm thick including accessories, and providing masonry enclosure with cover plate having locking arrangement and watering pipe etc. (but without charcoal or coke and salt) as required.</td>
<td>Set</td>
<td>5</td>
<td></td>
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<td>7</td>
<td>EARCHARPL Salt/charcoal for plate earth electrode: Extra for using salt and charcoal for G.I. or copper plate earth electrode as required.</td>
<td>Set</td>
<td>5</td>
<td></td>
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<tr>
<td>8</td>
<td>EAR6GGIWR S/L SWG GI wire in ground: Supplying and laying 6 SWG G.I. wire at 0.50 metre below ground level for conductor earth electrode, including soldering etc. as required.</td>
<td>Meter</td>
<td>130.00</td>
<td></td>
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</tr>
<tr>
<td>9</td>
<td>Supplying/Laying of aluminium conductor XLPE/PVC insulated armoured and served cable to be laid loose in the existing trench or pipe</td>
<td></td>
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</tr>
<tr>
<td>A</td>
<td>Aluminium conductor XLPE/PVC insulated PVC sheathed armoured and served cable working voltage 1100V grade 10 sq.mm. (2 core)</td>
<td>Meter</td>
<td>2000.00</td>
<td></td>
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<tr>
<td>No.</td>
<td>Description</td>
<td>Unit</td>
<td>Quantity</td>
<td></td>
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<td>------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
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<tr>
<td>B</td>
<td>Aluminium conductor XLPE/PVC insulated PVC sheathed armoured and served cable working voltage 1100V grade 16 sq.mm. (4 core)</td>
<td>Meter</td>
<td>3010.00</td>
<td></td>
<td></td>
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<tr>
<td>10</td>
<td>Supp &amp; fixing of GI pipe pole 80 mm dia 3.00 m long with 1 No. (80 mm to 50 mm dia) reducer and 40 mm dia 15 cm long GI pipe duly welded on base plate of size 30 cm x 30 cm. To be welded in the bottom of the pole including the cost of digging &amp; fixing of pole with 1:4:8 cement concrete Mix foundation &amp; 30 cm high round/ square plinth as per direction of E I/c</td>
<td>Nos</td>
<td>75</td>
<td></td>
<td></td>
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<tr>
<td>11</td>
<td>S/F of 100 Amp. V415 TPN metal clad rewireable type switch fuse unit on angle iron bracket grouted on wall complete in all respect</td>
<td>Nos</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>S/F of Feeder Pillar Box (Detail for one Box) : 2+12 way, Enclosure(607713) – 1 No 63 Amp. DP Isolator – 1 No 6-10 Amp. Sp MCB – 12 No 365 days 24 hour Timer – 1 No TP Contractor 63 Amp. – 1 No Voltage Stabilizer 2 KW 1 Phase – 1 No</td>
<td>Nos</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Outdoor Post Top Fittings. 1x14 w LED bulb. Complete fixture with bracket.</td>
<td>Nos</td>
<td>75</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>SPMCBDB S/F SP MCB DB: Supplying and fixing following way, single pole and neutral, sheet steel, MCB distribution board, 240 volts, on surface/recess, complete with tinned copper busbar, neutral busbar, earth bar, din bar, detachable gland</td>
<td>Each</td>
<td>75</td>
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<tr>
<td>plate, interconnections, phosphatized and powder painted including earthing etc. as required. (But without MCB/RCCB/Isolator) 4 way, Double door</td>
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<tr>
<td>15</td>
<td>MCBC S/F 'C' series, SP MCB Supplying and fixing 5 amps to 32 amps rating, 240 volts, 'C' series, miniature circuit breaker suitable for inductive load of following poles in the existing MCB DB complete with connections, testing and commissioning etc. as required Single pole</td>
<td>Each</td>
<td>150</td>
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</tbody>
</table>

1. **Total Amount (in INR) – in figures**

2. **Total Amount (in INR) – in words**
## ENVIRONMENTAL BUDGET FOR KARTIKEYSWAMI TEMPLE

<table>
<thead>
<tr>
<th>S.N.</th>
<th>Particulars</th>
<th>Stages</th>
<th>Unit</th>
<th>Total</th>
<th>Rate (INR)</th>
<th>Cost (INR)</th>
<th>Source of fund</th>
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<tbody>
<tr>
<td></td>
<td>Monitoring Measures</td>
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<td>1</td>
<td>Air Quality Monitoring</td>
<td>Construction</td>
<td>Per sample</td>
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<td>10,000</td>
<td>40,000</td>
<td>Contractor budget</td>
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<td>2</td>
<td>Noise Levels Silence Zones</td>
<td>Construction</td>
<td>Per location</td>
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<td>4,000</td>
<td>16,000</td>
<td>Contractor budget</td>
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<td>Ambient Air Quality</td>
<td>Operation</td>
<td>Per Sample</td>
<td>4</td>
<td>10,000</td>
<td>40,000</td>
<td>PMU</td>
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<tr>
<td>4</td>
<td>Ambient Noise Quality</td>
<td>Operation</td>
<td>Per Sample</td>
<td>4</td>
<td>4,000</td>
<td>16,000</td>
<td>PMU</td>
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<td>Sub- Total (A)</td>
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<td>1,12,000</td>
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<td></td>
<td>B  Capacity Building- Training Cost</td>
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<td>1</td>
<td>Sensitization workshop</td>
<td>Construction</td>
<td>LS</td>
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<td>PMU</td>
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<tr>
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<td>Sub- Total (B)</td>
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<td>3,00,000</td>
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<td>Total (A+B) INR</td>
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The Contractor will have to pay INR 56000.00 from his own personal financial resource for the activities during Construction phase.